PB89-107882

Nonmethane Organic Compound and Air Toxics Monitoring Program. Final Report 1987. Volume 1. Hydrocarbons

Radian Corp., Research Triangle Park, NC

Prepared for

Environmental Protection Agency
Research Triangle Park, NC

Aug 88

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-450/4-88-011	2.	3. RECIPIENT'S ACCESSION NO. PB89 107882/AS
4. TITLE AND SUBTITLE 1987 Nonmethane Organic Compound Monitoring Program Volume 1 - Hydrocarbons		5. REPORT DATE August 1988
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Air Quality Planning and Standards (MD-14)		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

EPA Project Officer: Harold G. Richter

16. ABSTRACT

Samples of ambient air were collected at 32 sites in the U.S. during June through September 1987 on week days from 0600 to 0900 hours. Analysis for the NMOC concentration was by PDFID. Data were used in the EKMA ozone model. An extensive QA program carried out with the samples shows good precision and accuracy of the method. Data from all the samples are tabulated together with an extensive discussion of the QA program.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
NMOC Data		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES [illegible]
	20. SECURITY CLASS (This page)	22. PRICE

PB89-107882

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/4-88-011
August 1988

Air

EPA

1987 Nonmethane Organic Compound And Air Toxics Monitoring Program Final Report Volume 1—Hydrocarbons

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

EPA-450/4-88-011

1987 Nonmethane Organic Compound And Air Toxics Monitoring Program Final Report

Volume 1—Hydrocarbons

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August 1988

i.a

This report has been reviewed by the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, and has been approved for publication as received from the contractor. Approval does not signify that the contents necessarily reflect the views and policies of the Agency. Neither does mention of trade names or commercial products constitute endorsement or recommendation for use.

EPA-450/4-88-011

PREFACE

This document, 1987 NONNMETHANE ORGANIC COMPOUND MONITORING REPORT, VOL 1, HYDROCARBONS, summarizes the data obtained from a program designed to obtain nonmethane organic compound (NMOC) information needed by state agencies to prepare their ozone state implementation plans (SIP). Similar programs were carried out in 1984. 1985, and 1986, but data from those programs were not widely distributed. Because of increased concern about ambient NMOC concentrations, these data from the 1987 studies are being made available for wider use.

The method for analysis of the samples was preconcentration, flame ionization detection (PDFID) developed in 1983 by the Environmental Monitoring and Systems Laboratory at Research Triangle Park, NC (EMSL/RTP).* This method produces reliable, high quality NMOC data in contrast to that produced by the continuous hydrocarbon analyzers used in years prior to 1984. During all of the monitoring programs, 1984-1987, an extensive quality assurance (QA) program was carried out to assure that the data met rigid standards. Much of the body of this report is devoted to a discussion of the data from that QA program.

The NMOC data collected during this study were for use as one input to the Environmental Kinetic Modeling Approach (EKMA). That model requires average NMOC/NO_x ratios from the 6 to 9 AM time period. The samples were collected only during the ozone season in most states - June through September. Thus, the data in this report are not representative of 24-hour average concentrations at the individual sites, nor can they be used to infer annual average concentrations of ambient NMOC.

During large measurement programs, many people contribute to their success. It is impossible to acknowledge everyone by name. However, the following Radian Corporation personnel were especially important to the success of this program: Dave-Paul Dayton, Robert F. Jongleux, Robert McAllister, and Phyllis O'Hara. In addition, the cooperation of state and local monitoring station operators was vital to smooth operation of the network. The dedication of all these people to seeing the project through is greatly appreciated.

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* For details of the PDFID method, the interested reader should consult Document No. PB 86-120631, A CRYOGENIC PRECONCENTRATION -DIRECT FID (PDFID) METHOD FOR MEASUREMENT OF NMOC IN AMBIENT AIR, available from the US Department of Commerce, National Technical Information Service.

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SYMBOLS AND ABBREVIATIONS

AC, or A.C.	area counts, generated from a gas chromatograph
ADELTA	absolute value of DELTA
ADIF	absolute value of DIF
ADIFF	absolute value of DIFF
AM	ante meridiem
APDIFF	absolute value of PDIFF
APDIF	absolute value of PDIF
ASRL	Atmospheric Sciences Research Laboratory (EPA)
ATGA	Atlanta, Georgia
Aug	August
B1MA	Boston, Massachusetts (Chelsea)
B2MA	Boston, Massachusetts (E. Boston)
BACA	Bakersfield, California
BHAL	Birmingham, Alabama
Bldg.	building
BMTX	Beaumont, Texas
BNY	New York, New York (Bronx)
BRLA	Baton Rouge, Louisiana
C1IL	Chicago, Illinois (State Office Building)
C3IL	Chicago, Illinois (Sears Tower)
Cal., or Calib.	calibration
CIOH	Cincinnati, Ohio
cm	centimeter
DELTA	Radian NMOC concentration - QAD NMOC concentration, ppmC; Radian NMOC concentration - ASRL concentration, ppmC; or ASRL NMOC concentration - QAD NMOC concentration, ppmC
DEGA	Atlanta, Georgia (Decatur)
DIF	(NMOC concentration for the second channel) - (NMOC concentration for the first channel
DIFF	measured NMOC concentration - calculated NMOC concentration ppmC for in-house quality control samples
DLTX	Dallas, Texas
Dup.	duplicate
e	base of natural logarithm, 2.71828...
ECD	electron capture detector
ELCA	El Cajon, California
ELTX	El Paso, Texas
EPA	United States Environmental Protection Agency
F	Friday
FID	flame ionization detector
FRCA	Fresno, California
FWTX	Fort Worth, Texas
GC/ECD	gas chromatography electron capture detection
GC/FID	gas chromatography flame ionization detection
GC/MS	gas chromatography mass spectrometry
H	Thursday
H1TX	Houston, Texas
Hg	mercury
HTCT	Hartford, Connecticut

(continued)

SYMBOLS AND ABBREVIATIONS (continued)

i.d.	inside diameter
ID	identification
INST.	instrument
Jul	July
Jun	June
L1KY	Louisville, Kentucky
L	liter
LICA	Livermore, California
Lpm	liters per minute
LVTX	Longview, Texas
m	meter
M	Monday
MAX	maximum
MIN	minimum
min.	minute
mL	milliliter
mm	millimeter
MNY	New York, New York (Manhattan)
MU	mean of ln(NMOC)
NBS	National Bureau of Standards
NC	North Carolina
NMOC	Nonmethane organic compound
NOx	oxides of nitrogen
Oct	October
o.d.	outside diameter
Off.	Office
P1OR	Portland, Oregon
PCDIFF	percent difference = DIFF/calculated NMOC concentration x 100, for in-house QC samples
PDELTA	$\frac{\text{DELTA}}{[(\text{Radian NMOC concentration + QAD NMOC concentration})/2]} \times 100$; $\frac{\text{DELTA}}{[(\text{Radian NMOC concentration + ASRL NMOC concentration})/2]} \times 100$; or, $\frac{\text{DELTA}}{[(\text{ASRL NMOC concentration + QAD NMOC concentration})/2]} \times 100$
PDFID	preconcentration, direct flame ionization detection
PDIF	DIF/([(NMOC concentration, 1st channel) + (NMOC concentration, 2nd channel)]/2) x 100
PICA	Pittsburg, California
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
ppmC	parts per million by volume as carbon
ppmv	parts per million by volume
psi	pounds (force) per square inch
psig	pounds (force) per square inch gauge

(continued)

SYMBOLS AND ABBREVIATIONS (concluded)

QA	quality assurance
QAD	Quality Assurance Division (EPA)
QAPP	Quality Assurance Project Plan
QC	quality control
RAO	Radian analysis order: RAO = 1 for the local ambient duplicate sample analyzed first by Radian; RAO = 2 for the local ambient duplicate sample analyzed first by EPA
RT	retention time
RTP	Research Triangle Park
S1UT	Salt Lake City, Utah (North)
S2UT	Salt Lake City, Utah (Central)
SDCA	San Diego, California
Sep	September
SLMO	St. Louis, Missouri
SFCA	San Francisco, California
SOP	standard operating procedure
SOx	oxides of sulfur
SRM	Standard Reference Material
SIGMA	standard deviation of ln(NMOC)
STD. DEV., SD	standard deviation
T	Tuesday
U.S.	United States
VICA	Visalia, California
W	Wednesday
°C	degrees Celsius
°F	degrees Fahrenheit
%CV	percent coefficient of variation

1.0 NMOC SUMMARY AND CONCLUSIONS

In certain areas of the country where the National Ambient Air Quality Standard for ozone is being exceeded, additional measurements of ambient nonmethane organic compounds (NMOC) are needed to assist the affected states in developing revised ozone control strategies. Because of previous difficulty in obtaining accurate NMOC measurements, the U.S. Environmental Protection Agency (EPA) has provided monitoring and analytical assistance to these states through Radian Corporation. This assistance began in 1984. Between June 1 and October 30, 1987, Radian analyzed 2,746 ambient air samples, collected in electropolished stainless steel canisters at 32 sites. These NMOC analyses were performed by the cryogenic preconcentration, direct flame ionization detection (PDFID) method, using four identical channels. Based on the 1984, 1985, and 1986 studies, the method was shown to be precise, accurate, and cost effective relative to the capillary column gas chromatographic, flame ionization detection (GC/FID) method. The 1987 study confirmed these findings and supported the conclusion that the PDFID method is the method of choice to measure NMOC concentration in ambient air.

In 1986, specific toxic compounds, primarily aromatics and halocarbons, were detected in the ambient air samples used for the NMOC analyses. In 1987, Radian Corporation developed a sample interface system and a three detector gas chromatographic analytical system to determine the concentration of selected air toxic compounds in ambient air. Fifteen of the 32 NMOC sites participated in the 3-hour air toxics program in 1987, and used the same ambient samples for the 3-hour air toxics analyses and the NMOC analyses.

1.1 NMOC DATA

Table 1-1 lists the site codes, numbers of scheduled samples, numbers of valid samples, percent completeness, and statistics for the NMOC concentrations in parts per million carbon (ppmC) by volume. Percent completeness, a quality measure which ratios the number of valid samples to the number of scheduled

TABLE 1-1. 1987 NMOC STATISTICS

Radian Site Code	Scheduled Sampling Days	Scheduled Duplicate Samples	Total Scheduled Samples	Total Valid Samples	Percent Complete	NMOC, ppmC						
						Minimum	Median	Mean	Maximum	Std.Dev.	Skewness	Kurtosis
B1MA	86	7	93	87	93.55	0.078	0.307	0.358	1.397	0.223	1.766	4.289
B2MA	86	6	92	94	102.17	0.123	0.477	0.693	3.433	0.632	2.573	6.844
HTCT	85	6	91	84	92.31	0.137	0.370	0.438	1.170	0.217	1.037	0.839
BNY	85	6	91	84	92.31	0.160	0.641	0.737	1.812	0.405	0.854	-0.163
MNY	85	6	91	77	84.62	0.203	0.711	0.760	1.494	0.265	0.440	0.095
NWNJ	86	6	92	90	97.83	0.165	0.712	0.765	1.764	0.354	0.681	-0.019
ATGA	81	6	87	87	100.00	0.191	0.663	0.770	2.213	0.420	0.856	0.288
DEGA	81	6	87	87	100.00	0.103	0.397	0.480	1.257	0.300	0.763	-0.512
BHAL	84	6	90	91	101.11	0.214	0.907	1.171	4.448	0.929	1.213	0.843
L1KY	85	6	91	85	93.41	0.366	0.811	1.252	10.767	1.553	4.629	23.513
C1IL	85	6	91	83	91.21	0.301	1.291	1.340	3.470	0.495	1.072	3.328
C3IL	86	6	92	86	93.48	0.053	0.357	0.488	2.280	0.408	1.824	3.951
CIOH	86	6	92	90	97.83	0.152	0.530	0.660	2.348	0.448	1.937	4.081
BRLA	86	6	92	93	101.09	0.121	0.632	0.759	3.053	0.526	1.674	3.283
BMTX	87	6	93	95	102.15	0.128	0.512	0.675	2.670	0.542	1.844	3.497
DLTX	84	6	90	78	86.67	0.159	0.475	0.571	2.087	0.342	1.708	3.948
ELTX	86	6	92	91	98.91	0.045	0.376	0.437	2.095	0.313	2.304	8.291
FWTX	81	6	87	79	90.81	0.277	0.660	0.861	3.279	0.631	2.427	6.030
H1TX	86	6	92	90	97.83	0.237	0.817	0.969	3.060	0.611	1.661	2.732
LVTX	80	5	85	85	100.00	0.154	0.422	0.574	1.483	0.355	1.132	0.129
SLMO	85	6	91	87	95.60	0.182	0.597	0.880	4.475	0.873	2.623	6.540
S1UT	87	6	93	84	90.32	0.132	0.866	0.957	2.242	0.437	0.779	0.453
S2UT	86	6	92	71	77.17	0.127	0.754	0.837	1.824	0.424	0.643	-0.319
ELCA	86	6	92	86	93.48	0.107	0.282	0.323	1.567	0.198	3.442	17.380
FRCA	83	7	90	89	98.89	0.257	0.775	1.414	9.984	1.864	3.326	11.180
LICA	86	5	91	92	101.10	0.142	0.789	0.862	3.462	0.466	2.299	9.585
SDCA	86	6	92	80	86.96	0.118	0.312	0.423	1.728	0.308	1.933	3.997
SFCA	86	6	92	91	98.91	0.091	0.242	0.345	1.825	0.292	2.712	8.235
VICA	84	5	89	84	94.38	0.150	0.421	0.575	5.309	0.620	5.787	39.641
P1OR	85	4	89	84	94.38	0.073	0.266	0.357	1.313	0.271	1.859	3.499
BACA	75	4	79	73	92.41	0.341	1.486	1.424	2.733	0.560	-0.042	-0.816
PICA	87	4	91	89	97.80	0.164	0.416	0.543	5.243	0.573	6.411	49.394
Overall.	2707	185	2892	2746	94.95	0.045	0.559	0.738	10.767	0.634	5.476	54.383

samples, averaged 95.0% in 1987 compared to 96.1% in 1986. Percent completeness ranged from 77.2% for the Salt Lake City (S2UT) central city site to 102.2% for Beaumont, Texas (BMTX). The Beaumont site surpassed 100% by taking samples on a holiday (July 3rd), and on October 1, 1987, when no sampling had been scheduled for BMTX.

1.2 NMOC CALIBRATION AND DRIFT

Each Radian PDFID channel was calibrated twice daily, using propane standards referenced to the National Bureau of Standards (NBS) Standard Reference Material (SRM) No. 1667b propane. Zero readings were determined with cleaned, dried air. Daily percent drift of the calibration factor ranged from -5.7% to +7.7%, averaging 0.98%. The absolute value of the percent drift of the daily calibration factors ranged from zero to 7.7%, averaging 1.44%.

1.3 NMOC PRECISION

Analytical precision was determined by repeated analyses of 157 site samples. Percent differences between the second and the first analysis averaged -3.72%. The average of the absolute values of the percent difference was 9.6%. The analytical precision includes the variability between Radian channels and within Radian channels.

Overall precision, including sampling and analysis variability, was determined by repeated analyses of 232 duplicate site samples, simultaneously collected in two identical canisters from a common sampling system. Percent difference for Radian's analyses of the duplicates averaged -2.92%. The average absolute percent difference was 15.4% with a standard deviation of 23.1.

1.4 NMOC ACCURACY

Because the NMOC measurements encompass a range of mixtures of unknown compounds, it was not possible to define absolute accuracy. Instead, accuracy was determined relative to propane standards with internal and external audit samples.

Accuracy was monitored internally throughout the program by the use of in-house propane standards. Four days per week an in-house propane quality control (QC) sample was prepared and analyzed. The propane used to prepare the in-house QC standards was certified by the EPA-Quality Assurance Division (QAD) and was referenced to NBS SRM 1667b.

Figures 1-1 through 1-4 show the in-house quality control results for Radian Channels A, B, C, and D. Measured propane values are plotted against calculated propane standards. Table 1-2 shows the orthogonal regression parameters for the Radian in-house quality control data. Daily quality control samples of propane were mixed from a propane standard certified by EPA-QAD and referenced to NBS SRM propane Standard No. 1667b. The regression used the propane concentration calculated from the mixing operation to the concentration measured by each Radian Channel. The concentration range of the in-house quality control samples was 0.0 to 9.0 ppmC. Table 1-2 indicates excellent quality control for each channel since the intercepts are all near zero, and the slopes and coefficients of correlation are all near 1.0, as expected.

External propane audit samples were provided by the EPA-QAD. The propane samples were referenced to NBS SRM propane Standard No. 1667b. Table 1-3 summarizes the percent bias of the Radian channels and the EPA-Atmospheric Sciences Research Laboratory (ASRL) channel relative to the EPA-QAD channel. The average percent bias for the Radian channels was -1.31%, ranging from -2.88% for Channel B to -0.061% for Channel A. Absolute percent biases are listed in Table 1-4 and range from 1.69% for Channel A to 3.56% for Channel B, averaging 2.68% overall for the Radian channels.

1.5 OTHER QUALITY ASSURANCE MEASURES

The results of other quality assurance measures are discussed below. Canister cleanup studies established that there was little carryover of NMOC from one sample to the next, when using the canister cleanup apparatus and procedure developed for this study. In 419 separate determinations, percent cleanup averaged 99.374%, ranging from 92.1% to 100%. Cleanup was defined in terms of the percent of the NMOC concentration that was removed in three cleanup cycles of evacuating the canister followed by filling the canister with cleaned, dried air that had been humidified. In 1987, the canister cleanup procedure was changed to use cleaned, dried air that had been humidified instead of cleaned, dried air. It has been found that in the cleanup cycle, humidified air (that had been previously cleaned and dried) did a better job of removing residual hydrocarbon that had adsorbed on canister surfaces, than cleaned, dried air alone.

Figure 1-5 shows a between-laboratory comparison of site sample analyses involving Radian channels and the EPA-QAD channel for the PDFID method.

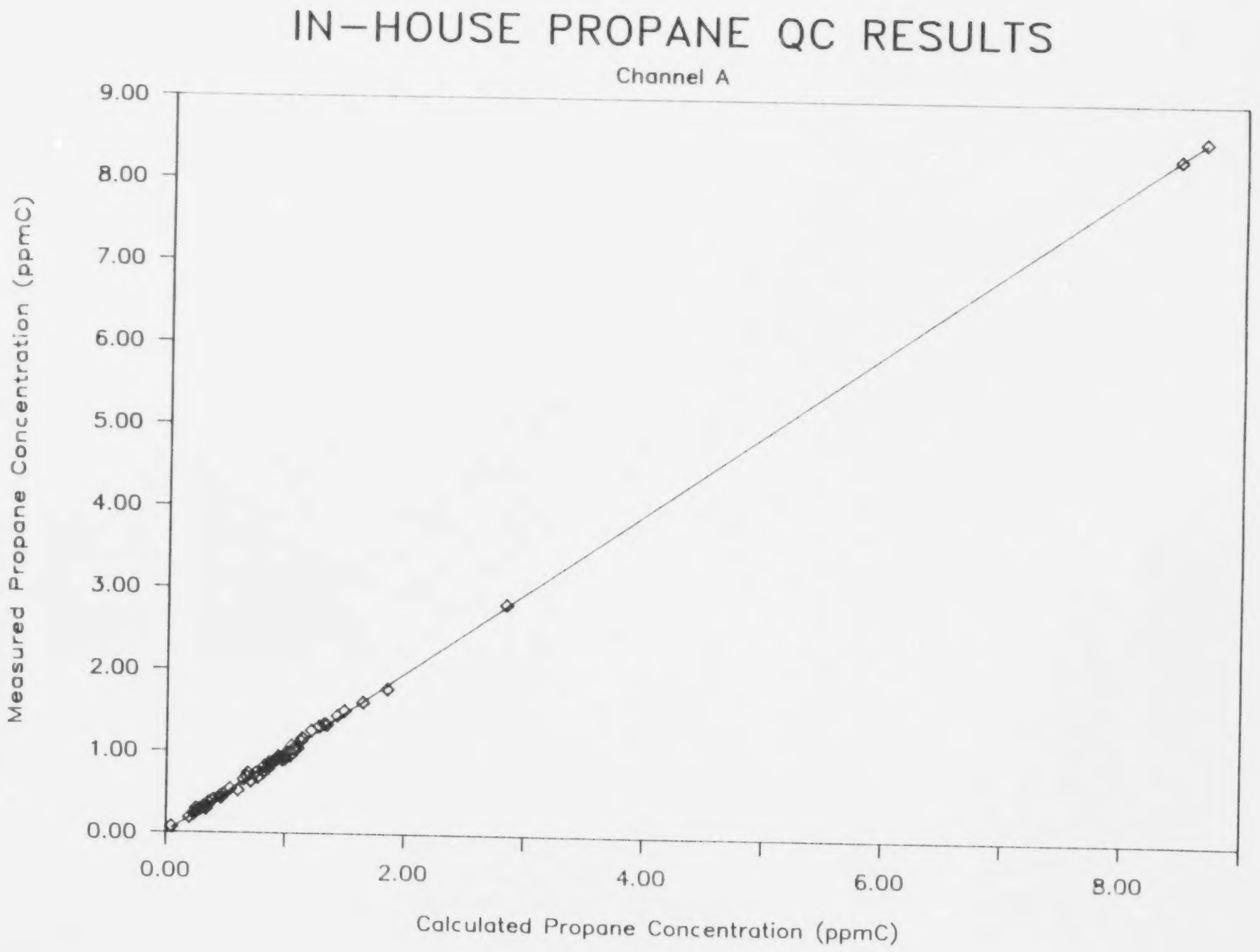

Figure 1-1. In-house quality control, orthogonal regression for Channel A.

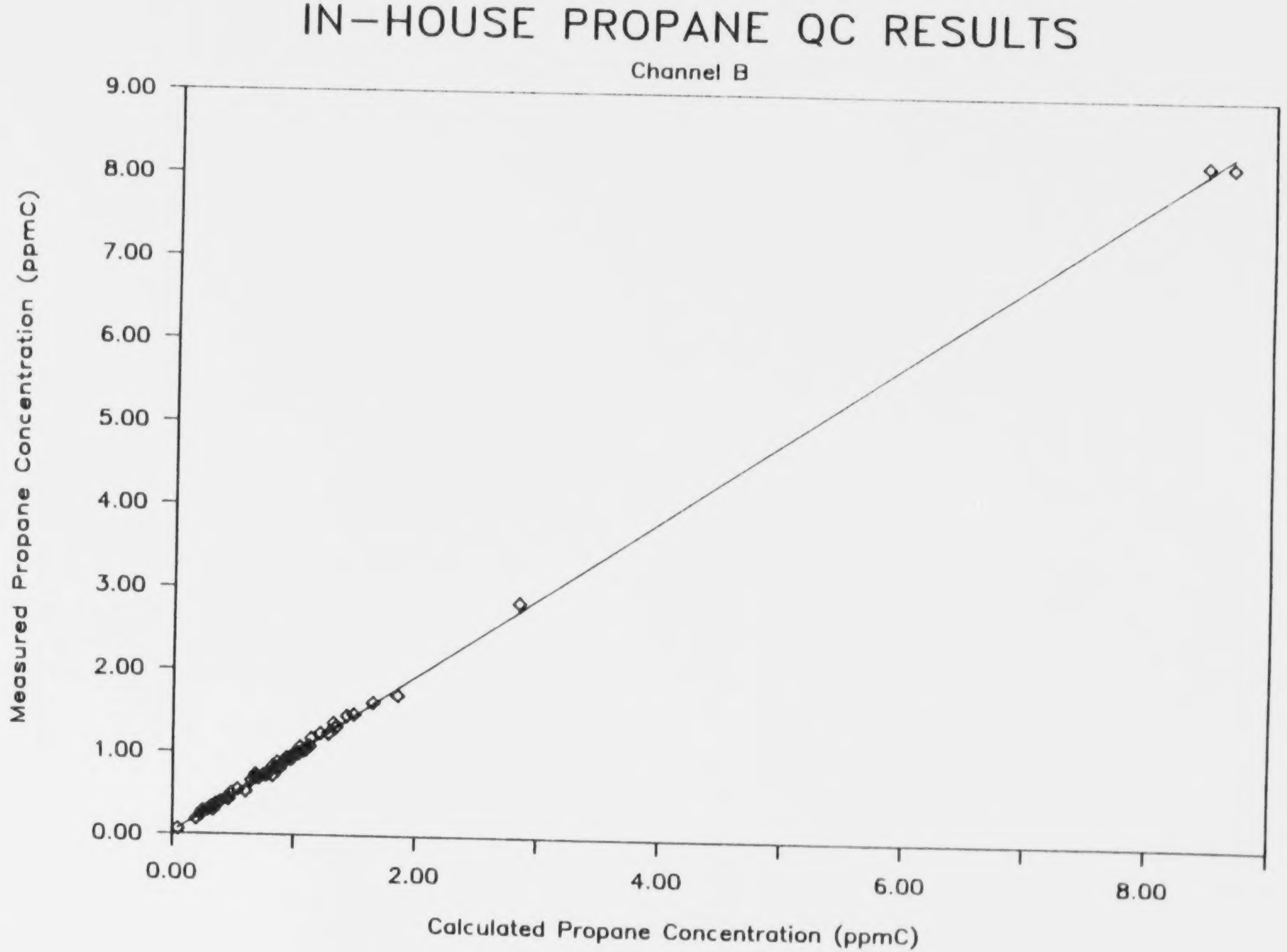

Figure 1-2. In-house quality control, orthogonal regression for Channel B.

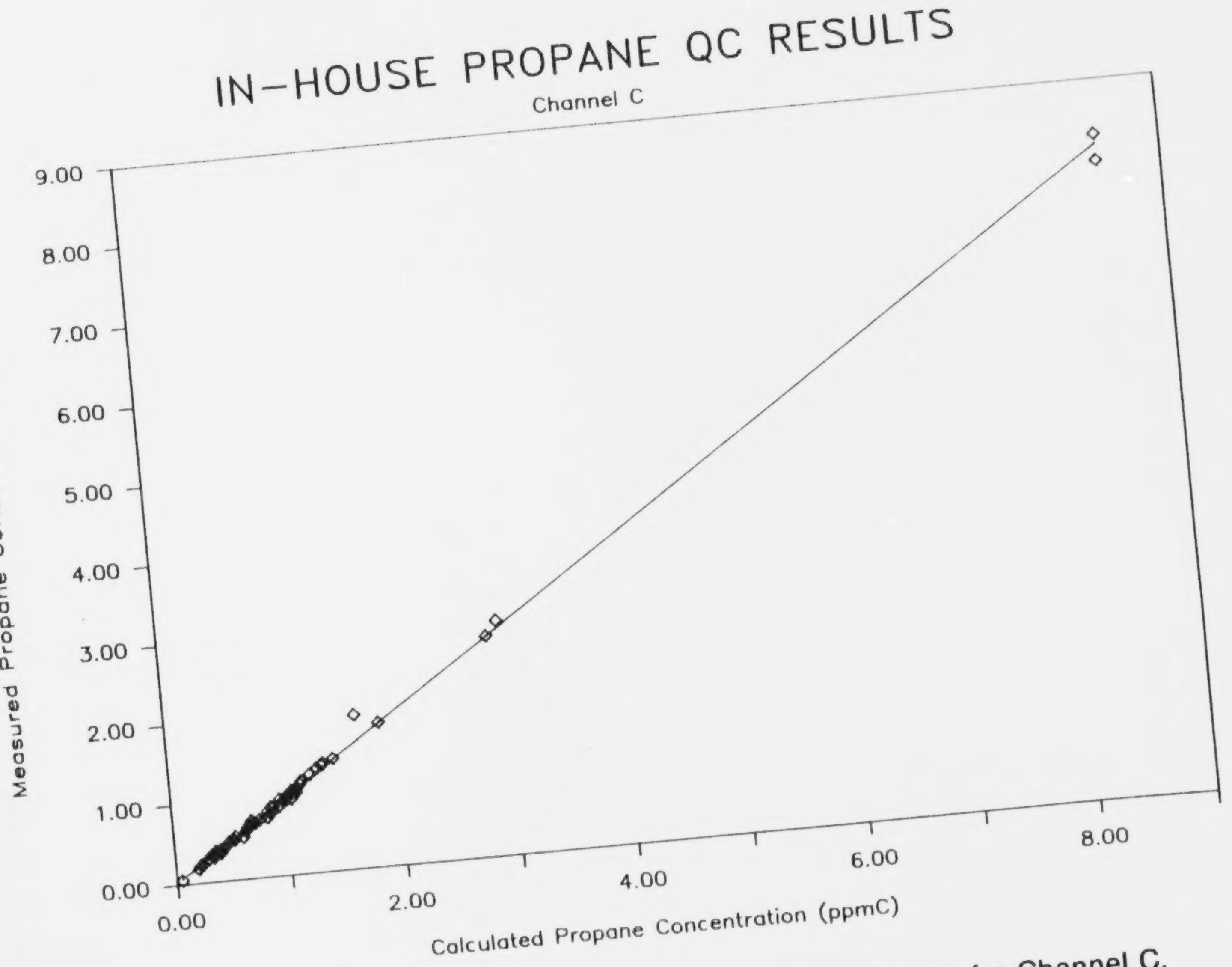

Figure 1-3. In-house quality control, orthogonal regression for Channel C.

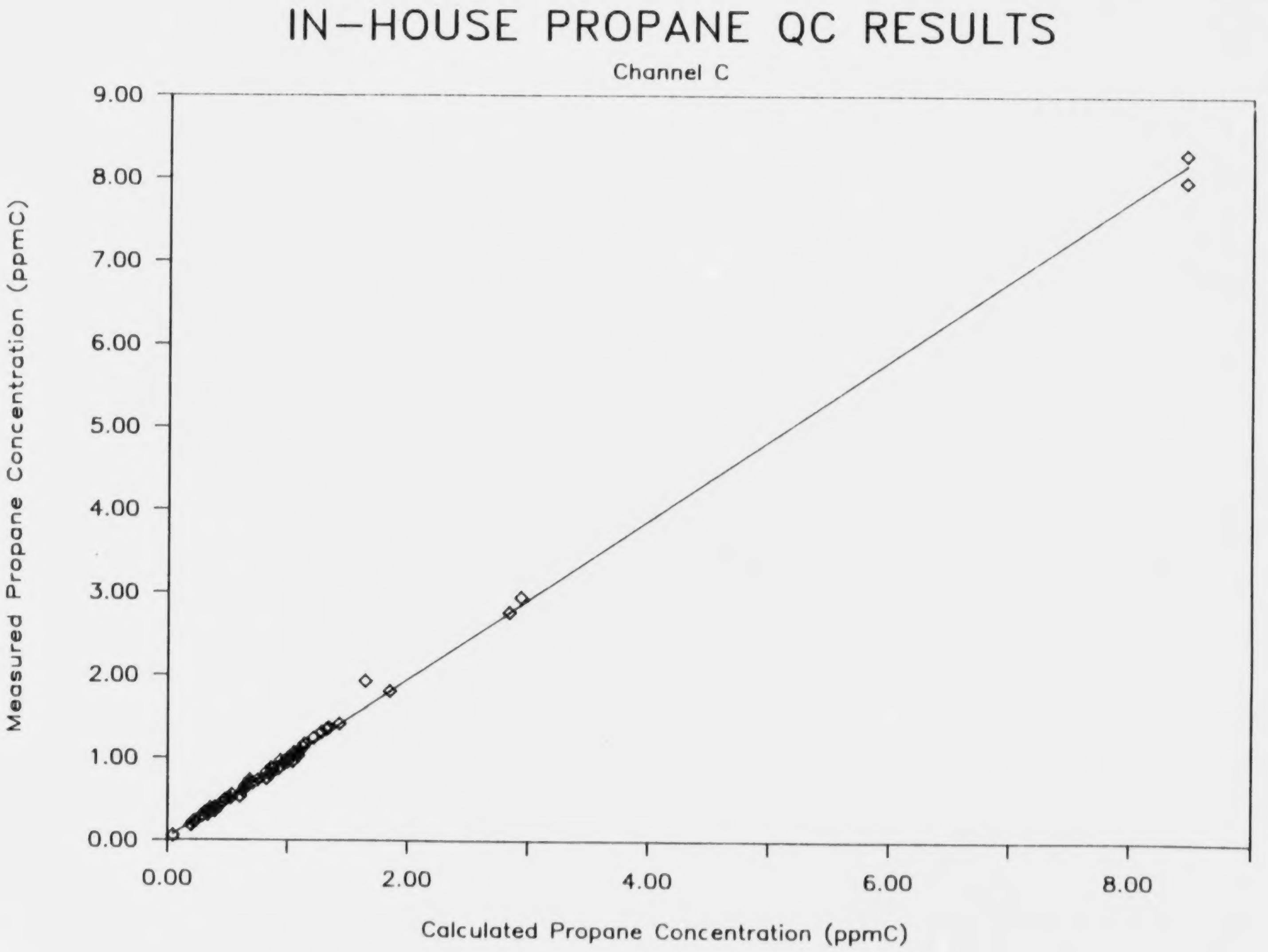

Figure 1-3. In-house quality control, orthogonal regression for Channel C.

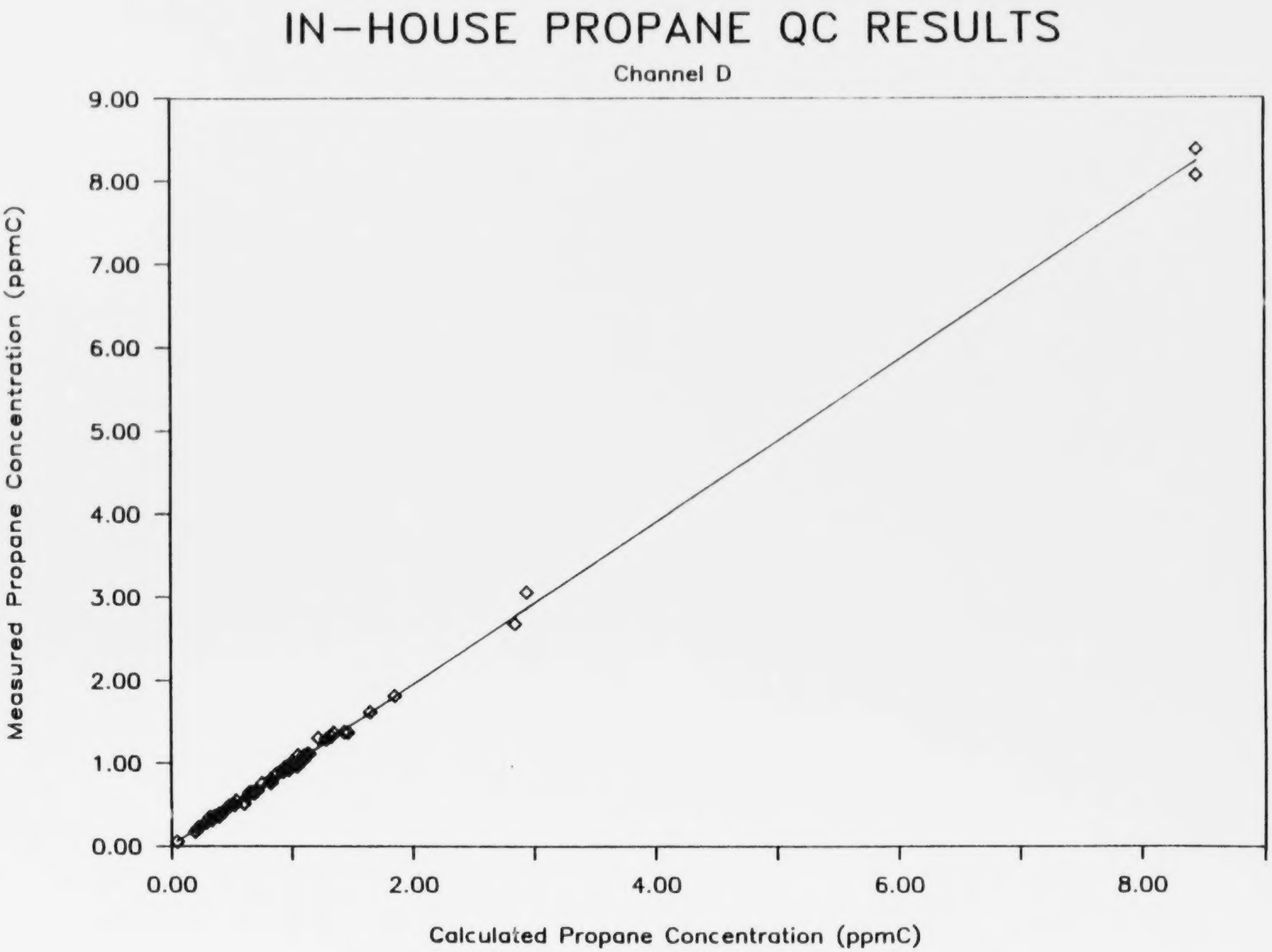

Figure 1-4. In-house quality control, orthogonal regression for Channel D.

TABLE 1-2. ORTHOGONAL REGRESSION PARAMETERS FOR IN-HOUSE QUALITY CONTROL DATA

Radian Channel	Number of Data	Intercept	Slope	Coefficient of Correlation
A	50	-0.002140	0.986320	0.999734
B	50	0.020943	0.959413	0.999582
C	52	0.024876	0.965475	0.999085
D	53	0.010937	0.973832	0.999392

TABLE 1-3. AUDIT SAMPLE RESULTS, PERCENT BIAS[a]

	Channel A Percent Bias	Channel B Percent Bias	Channel C Percent Bias	Channel D Percent Bias	Radian Percent Bias	EPA-ASRL Percent Bias
	0.18692	-1.12150	1.12150	-1.68224		-
	-4.63964	-10.00000	-5.76577	-8.44595		-
	-0.62500	-4.16667	-1.40625	-1.40625		-
	0.15232	-4.03656	-1.44707	-3.17339		-
	2.05942	0.27009	0.87779	3.37610		9.01418
	2.49867	1.75439	2.28602	1.91388		9.50027
AVERAGE	-0.06122	-2.88337	-0.72230	-1.56964	-1.30913	9.25722
STD.DEV.	2.54704	4.19953	2.87887	4.15909	3.52525	0.34371

[a] Percent Bias = (Measured NMOC - QAD NMOC)/QAD NMOC * 100.

TABLE 1-4. AUDIT SAMPLE RESULTS, ABSOLUTE PERCENT BIAS[a]

	Channel A Absolute Percent Bias	Channel B Absolute Percent Bias	Channel C Absolute Percent Bias	Channel D Absolute Percent Bias	Radian Absolute Percent Bias	EPA-ASRL Absolute Percent Bias
	0.18692	1.12150	1.12150	1.68224		-
	4.63964	10.00000	5.76577	8.44595		-
	0.62500	4.16667	1.40625	1.40625		-
	0.15232	4.03656	1.44707	3.17339		-
	2.05942	0.27009	0.87779	3.37610		9.01418
	2.49867	1.75439	2.28602	1.91388		9.50027
AVERAGE	1.69366	3.55820	2.15073	3.33297	2.68389	9.25722
STD.DEV.	1.74635	3.52417	1.83390	2.63138	2.53756	0.34371

[a] Absolute Percent Bias = Absolute Value of
(Measured NMOC - QAD NMOC)/QAD NMOC * 100

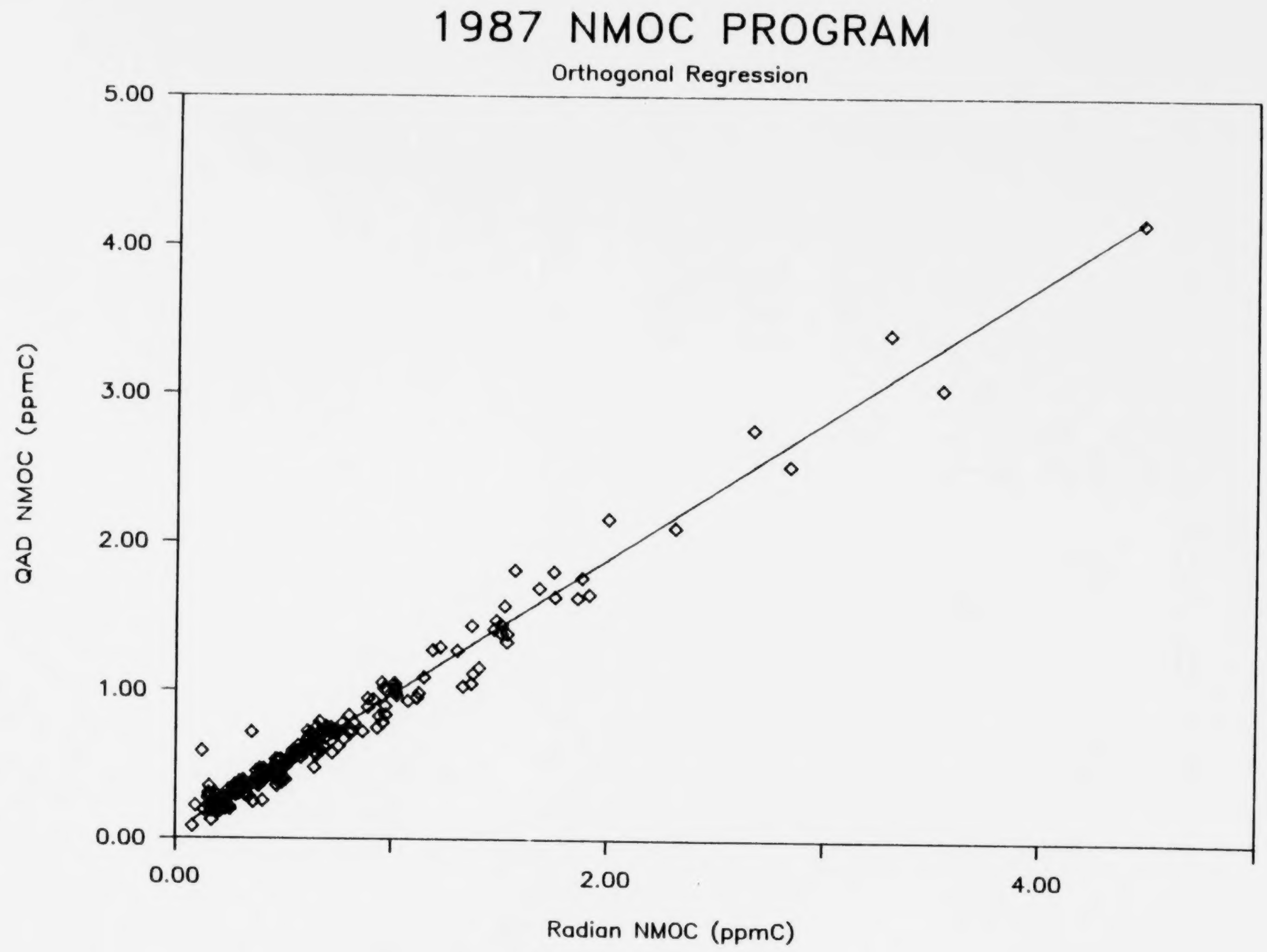

Figure 1-5. Orthogonal regression comparing QAD with Radian NMOC analyses.

Figure 1-6 compares EPA-ASRL for the GC/FID method with the Radian analyses for the PDFID method, and is a between-laboratory, between-method comparison. Figure 1-7 shows comparisons of EPA-ASRL and EPA-QAD channels. Table 1-5 gives the orthogonal regression parameters, assuming a linear relationship, for Figures 1-5 through 1-7. The results show good agreement because the intercepts are very close to zero, the slopes are within 12 percent of 1.0, and the coefficients of correlation are within 2 percent of 1.0.

For selected values of NMOC measured by Radian channels, Table 1-6 gives the predicted NMOC values for the EPA-QAD and EPA-ASRL channels, based on the orthogonal regression parameters of Table 1-5. The agreement of the Radian measurements and the EPA-QAD expected values is excellent. The percent differences between predicted EPA and Radian NMOC measurements are largest at the lower range of NMOC values, as expected.

Approximately 10.1% of the NMOC data base was validated by checking data transcriptions from original data sheets for 54 entries per sample. The three errors found equal a database error rate of 0.017%.

Volume I of the Final Report includes Sections 1.0 through Sections 7.0, and reports the data, procedures, and assessment of the NMOC portion of the monitoring program. Sections 8.0 through 12.0 are included in Volume II, and report the data, procedures, and assessment of the air toxics portion of the air toxics monitoring program.

In October 1987, 19 sites began collecting 24-hour ambient air samples on 12-day, year-round schedule. Sampling and analytical results from the 24-hour ambient air samples will be reported separately, since they are not part of the NMOC monitoring program, and are on a 12-month sampling schedule.

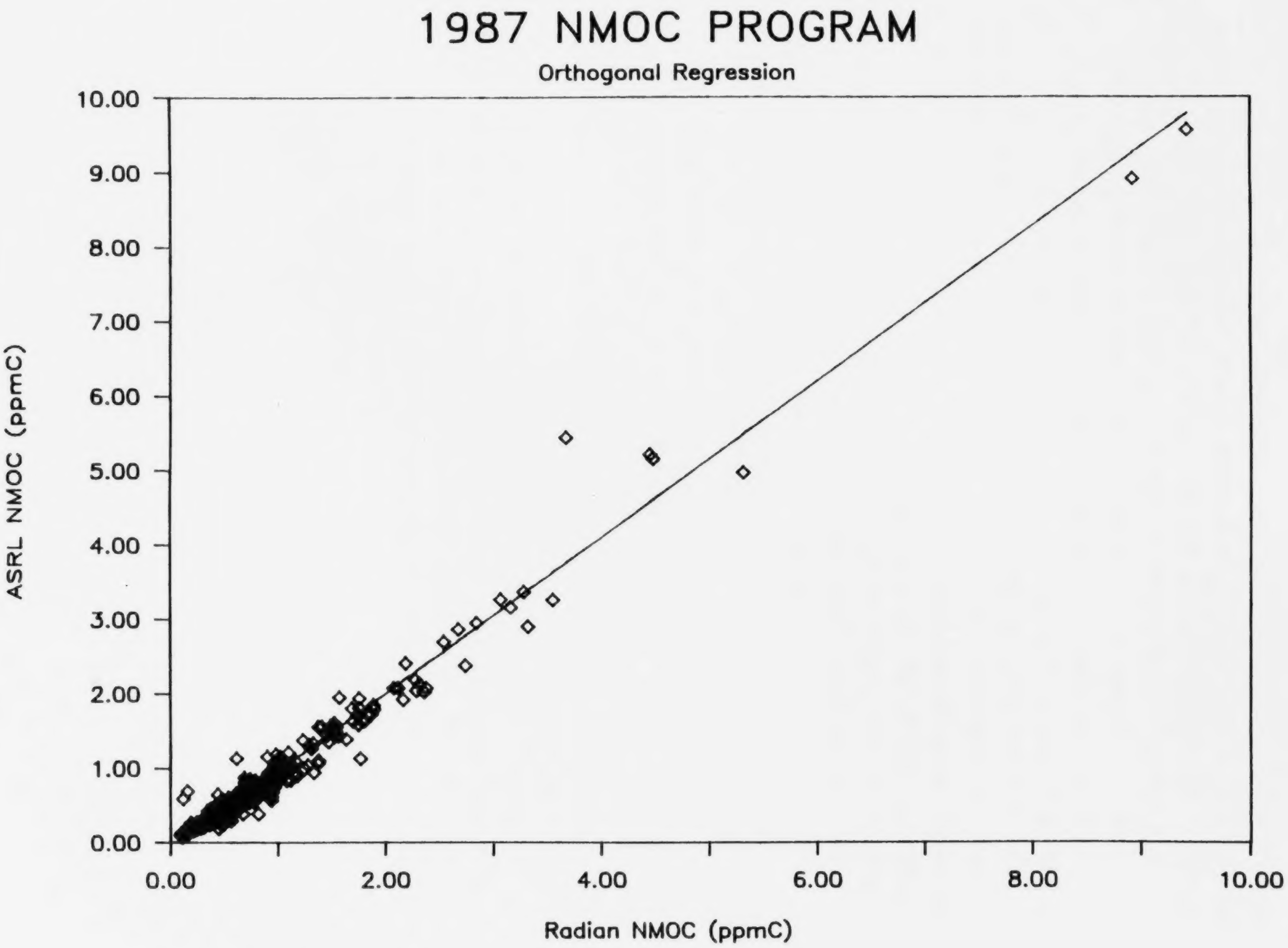

Figure 1-6. Orthogonal regression comparing ASRL with Radian NMOC analyses.

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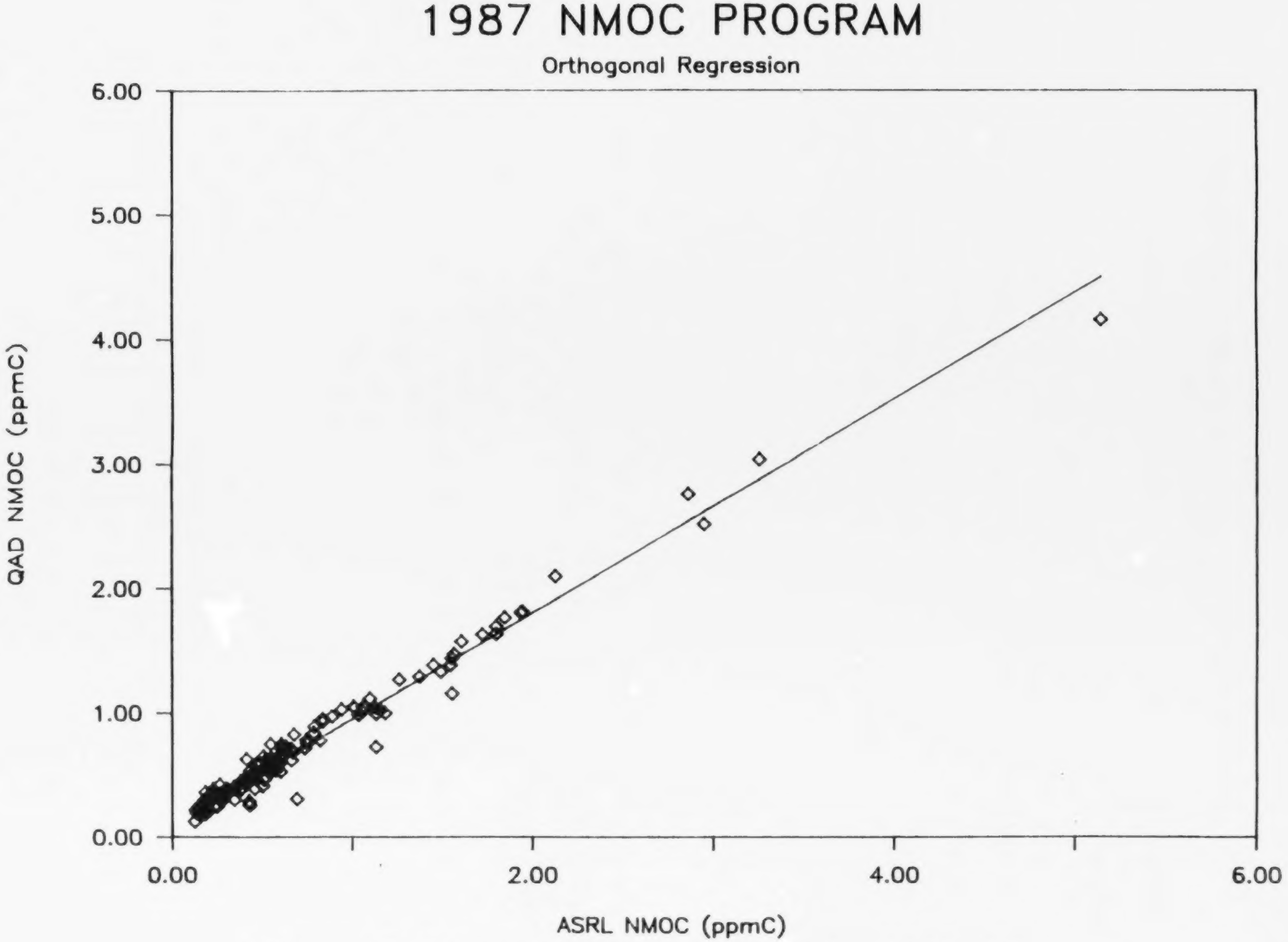

Figure 1-7. Orthogonal regression comparing ASRL with QAD NMOC analyses.

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TABLE 1-5. ORTHOGONAL REGRESSION PARAMETERS FOR REPEATED ANALYSES OF SITE SAMPLES

Channel Pair	Number of Data	Intercept	Slope	Coefficient of Correlation
QAD-Radian	192	0.050041	0.922151	0.986502
ASRL-Radian	306	-0.08213	1.046873	0.988228
ASRL-QAD	132	0.096856	0.857136	0.987968

TABLE 1-6. EXPECTED VALUES OF EPA-QAD AND EPA-ASRL NMOC CONCENTRATIONS

Hypothetical Radian NMOC ppmC	Predicted NMOC QAD ppmC	Predicted NMOC ASRL ppmC	Radian-QAD % Difference	Radian-ASRL % Difference
0.2	0.234	0.127	-14.5	+57.2
0.5	0.511	0.441	-2.1	+13.3
1.0	0.972	0.965	+2.9	+3.6
5.0	4.661	5.152	+7.2	-2.9

2.0 NMOC DATA SUMMARY

This section presents the data summary for the 1987 NMOC Sampling and Analysis Program conducted during June, July, August, September, and October. The majority of the data presented in this section pertain to the NMOC concentrations measured for samples collected at 32 sites throughout the continental United States. Sites were located in the urban and/or industrial locations listed in Appendix D. The site codes listed in Appendix D are used throughout the report to identify the sites. Samples were collected in stainless steel canisters by local site operators trained by Radian Corporation personnel. The sampling procedure was described in detailed written instructions provided to the site operators. A copy of these sampling procedure instructions is also included in Section 3. Analytical concentration measurements of NMOC were made in the Radian Corporation Perimeter Park (NC) laboratory under carefully controlled conditions.

The concentration of oxides of nitrogen (NOx), site temperature, barometric pressure, wind direction, and weather conditions were provided by site personnel at the time of sampling. These data were recorded in the 1987 NMOC data base, but are not presented in this report because they were not subjected to Radian Quality Assurance procedures.

Table 2-1 summarizes the 1987 NMOC data, sorted by region and listed alphabetically within region. The scheduling of sample days and the scheduling of duplicate samples are described in the Quality Assurance Project Plan (QAPP).[1] The total scheduled samples and the total valid samples were used to calculate the percent completeness values. In Table 2-1, the means are the arithmetic averages of the NMOC concentrations at each site. The standard deviations (Std.Dev.), skewness, and kurtosis are the second, third, and fourth moments, respectively about the arithmetic means. A skewness value

TABLE 2-1. 1987 NMOC STATISTICS

Radian Site Code	Scheduled Sampling Days	Scheduled Duplicate Samples	Total Scheduled Samples	Total Valid Samples	Percent Complete	NMOC, ppmC						
						Minimum	Median	Mean	Maximum	Std. dev.	Skewness	Kurtosis
B1MA	86	7	93	87	93.55	0.078	0.307	0.358	1.397	0.223	1.766	4.289
B2MA	86	6	92	94	102.17	0.123	0.477	0.693	3.433	0.632	2.573	6.844
HTCT	85	6	91	84	92.31	0.137	0.370	0.438	1.170	0.217	1.037	0.879
BNY	85	6	91	84	92.31	0.160	0.641	0.737	1.812	0.405	0.854	-0.163
MNY	85	6	91	77	84.62	0.203	0.711	0.760	1.494	0.265	0.440	0.095
NWNJ	86	6	92	90	97.83	0.165	0.712	0.765	1.764	0.354	0.681	-0.019
ATGA	81	6	87	87	100.00	0.191	0.663	0.770	2.213	0.420	0.856	0.288
DEGA	81	6	87	87	100.00	0.103	0.397	0.480	1.257	0.300	0.763	-0.512
BHAL	84	6	90	91	101.11	0.214	0.907	1.171	4.448	0.929	1.213	0.843
L1KY	85	6	91	85	93.41	0.366	0.811	1.252	10.767	1.553	4.629	23.513
C1IL	85	6	91	83	91.21	0.301	1.291	1.340	3.470	0.495	1.072	3.328
C3IL	86	6	92	86	93.48	0.053	0.357	0.488	2.280	0.408	1.824	3.951
CIOH	86	6	92	90	97.83	0.152	0.530	0.660	2.348	0.448	1.937	4.081
BRLA	86	6	92	93	101.09	0.121	0.632	0.759	3.053	0.526	1.674	3.283
BMTX	87	6	93	95	102.15	0.128	0.512	0.675	2.670	0.542	1.844	3.497
DLTX	84	6	90	78	86.67	0.159	0.475	0.571	2.087	0.342	1.708	3.948
ELTX	86	6	92	91	98.91	0.045	0.376	0.437	2.095	0.313	2.304	8.291
FWTX	81	6	82	79	90.81	0.277	0.660	0.861	3.278	0.631	2.427	6.030
H1TX	86	6	92	90	97.83	0.237	0.817	0.969	3.060	0.611	1.661	2.732
LVTX	80	5	85	85	100.00	0.154	0.422	0.574	1.483	0.355	1.132	0.129
SLMO	85	6	91	87	95.60	0.182	0.597	0.880	4.475	0.873	2.623	6.540
S1UT	87	6	93	84	90.32	0.132	0.866	0.957	2.242	0.437	0.779	0.453
S2UT	86	6	92	71	77.17	0.127	0.754	0.837	1.824	0.424	0.643	-0.319
ELCA	86	6	92	86	93.48	0.107	0.282	0.323	1.567	0.198	3.442	17.380
FRCA	83	7	90	89	98.89	0.257	0.775	1.414	9.984	1.864	3.326	11.180
LICA	86	5	91	92	101.10	0.142	0.789	0.862	3.462	0.466	2.299	9.585
SDCA	86	6	92	80	86.96	0.118	0.312	0.423	1.728	0.308	1.933	3.997
SFCA	86	6	92	91	98.91	0.091	0.242	0.345	1.825	0.292	2.712	8.235
VICA	84	5	89	84	94.38	0.150	0.421	0.575	5.309	0.620	5.787	39.641
P1OR	85	4	89	84	94.38	0.073	0.266	0.357	1.313	0.271	1.859	3.499
BACA	75	4	79	73	92.41	0.341	1.486	1.424	2.733	0.560	-0.042	-0.816
PICA	87	4	91	89	97.80	0.164	0.416	0.543	5.243	0.573	6.411	49.394
Overall:	2707	185	2892	2746	94.95	0.045	0.559	0.738	10.767	0.634	5.476	54.383

greater than zero applies to distributions having a longer tail to the right. A distribution that is normally distributed would have a kurtosis of 3.0. A distribution more peaked (or pointed) than a normal distribution, having the same variance, would have a kurtosis greater than 3.0.

Completeness figures for the 1987 NMOC Program show 95.0% complete. This compares with 96.8% complete in 1986, 95.8% complete in 1985 and 90.6% complete in 1984.[2,3,4] Completeness was defined as the percentage of samples, scheduled in the QAPP, that were collected and analyzed as valid samples, beginning with the first valid sample and ending with the last valid sample.

The overall (arithmetic) mean NMOC concentration for 1987 was 0.738 ppmC, 0.776 in 1986, 0.755 in 1985, and 0.853 in 1984.

The data from the 1987 NMOC program can be better characterized by a lognormal distribution than by a normal distribution. This follows the 1986 and 1985 findings.[2,3] Table 2-2 summarizes the 1987 NMOC data using the definitions which characterize a lognormal distribution, overall, and for each site. MU and SIGMA are the mean and standard deviation, respectively, of the logarithm of NMOC to the Napierian base e. The geometric mean is e raised to the power MU; the geometric standard deviation is e raised to the power SIGMA. The mode is the most frequently occurring NMOC value.

Table 2-3 itemizes the invalidated and missing samples chronologically. Table 2-4 lists the same information sorted by site code. The purpose of these tabulations was to characterize collection equipment, procedures, and problems to facilitate ongoing corrective action and to suggest procedural revisions for the future.

Figures 2-1 through 2-36 plot the measured NMOC concentration data for the 32 participating sites for 1987. Tables 2-5 through 2-36 present the site-specific data chronologically. Figures and tables are arranged by city, with, for example, the concentration plot for Atlanta, GA, facing the table of summary data for that city. Sites at Louisville, KY; Fresno, CA; Visalia, CA; and Pittsburg, CA have additional figures reflecting an expanded NMOC concentration scale. The summary data tables include:

- date sampled;
- Julian date sampled;
- weekday sampled (M, T, W, H, F);
- sample ID number, assigned consecutively upon receipt;
- sample canister number;

TABLE 2-2. 1987 NMOC LOGNORMAL STATISTICS

Radian Site Code	Logarithmic Normal Distribution of NMOC, ppmC						
	Minimum	Mode	Median	Mean	Maximum	MU[a]	SIGMA[b]
B1MA	0.078	0.223	0.307	0.357	1.397	-1.187	0.561
B2MA	0.123	0.340	0.477	0.672	3.433	-0.625	0.674
HTCT	0.137	0.309	0.370	0.439	1.170	-0.940	0.484
BNY	0.160	0.464	0.641	0.743	1.812	-0.454	0.560
MNY	0.203	0.636	0.711	0.765	1.494	-0.339	0.377
NWNJ	0.165	0.538	0.712	0.772	1.764	-0.379	0.490
ATGA	0.191	0.480	0.663	0.778	2.213	-0.412	0.567
DEGA	0.103	0.253	0.397	0.487	1.257	-0.938	0.661
BHAL	0.214	0.450	0.907	1.192	4.448	-0.149	0.806
L1KY	0.366	0.626	0.811	0.767	10.767	-0.062	0.637
C1IL	0.301	1.072	1.291	1.350	3.470	0.223	0.392
C3IL	0.053	0.190	0.357	0.496	2.280	-1.021	0.800
CIOH	0.152	0.392	0.536	0.656	2.348	-0.594	0.586
BRLA	0.121	0.413	0.632	0.758	3.053	-0.479	0.636
BMTX	0.128	0.309	0.512	0.672	2.670	-0.656	0.720
DLTX	0.159	0.362	0.475	0.571	2.087	-0.712	0.550
ELTX	0.045	0.217	0.376	0.445	2.095	-1.048	0.692
FWTX	0.277	0.529	0.660	0.843	3.278	-0.326	0.558
H1TX	0.237	0.594	0.817	0.965	3.060	-0.197	0.569
LVTX	0.154	0.351	0.422	0.413	3.155	-0.722	0.571
SLMO	0.182	0.416	0.597	0.839	4.475	-0.410	0.684
S1UT	0.132	0.668	0.866	0.969	2.242	-0.155	0.498
S2UT	0.127	0.515	0.754	0.858	1.824	-0.323	0.584
ELCA	0.107	0.229	0.282	0.319	1.567	-1.252	0.471
FRCA	0.257	0.458	0.775	1.303	9.987	-0.084	0.835
LICA	0.142	0.590	0.789	0.865	3.462	-0.272	0.505
SDCA	0.118	0.243	0.312	0.416	1.728	-1.056	0.598
SFCA	0.091	0.195	0.242	0.332	1.825	-1.279	0.596
VICA	0.150	0.330	0.421	0.547	5.309	-0.772	0.581
P1OR	0.073	0.182	0.266	0.356	1.313	-1.258	0.669
BACA	0.341	1.032	1.486	1.448	2.733	0.257	0.475
PICA	0.164	0.322	0.416	0.517	5.243	-0.817	0.562
Overall:	0.045	0.389	0.559	0.669	10.767	-0.582	0.601

[a] MU is the mean of ln(NMOC). e^{MU} is the geometric mean.

[b] SIGMA is the standard deviation of ln(NMOC). e^{SIGMA} is called the geometric standard deviation.

TABLE 2-3. 1987 NMOC STUDY, CHRONOLOGICAL INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
C1IL	06/02/87	SOLENOID FAILURE	EQUIPMENT
C1IL	06/03/87	SOLENOID FAILURE	EQUIPMENT
ELTX	06/03/87	ANALYSIS FAILURE	RADIAN
SDCA	06/03/87	CANISTER PRESSURE	EQUIPMENT
C1IL	06/04/87	SOLENOID FAILURE	EQUIPMENT
S2UT	06/04/87	CANISTER NOT OPENED	OPERATOR
SDCA	06/04/87	CANISTER PRESSURE	EQUIPMENT
B2MA	06/05/87	LOW PRESSURE	EQUIPMENT
C1IL	06/05/87	SOLENOID FAILURE	EQUIPMENT
C1IL	06/08/87	BROKEN FILTER	EQUIPMENT
C3IL	06/08/87	CANISTER NOT OPENED	OPERATOR
DLTX	06/09/87	LOW SAMPLE PRESSURE	EQUIPMENT
DLTX	06/10/87	LOW SAMPLE PRESSURE	EQUIPMENT
L1KY	06/10/87	CANISTER NOT OPENED	OPERATOR
BRLA	06/11/87	NO EXPLANATION	UNASSIGNED
DLTX	06/11/87	TIMER FAILURE	EQUIPMENT
MNY	06/12/87	FITTING STRIPPED	OPERATOR
LVTX	06/13/87	POWER FAILURE	SITE
MNY	06/15/87	SOLENOID LEAK	EQUIPMENT
VICA	06/15/87	MISSED SAMPLE	OPERATOR
BRLA	06/16/87	SAMPLE LINE DETACHED	OPERATOR
MNY	06/16/87	SOLENOID LEAK	EQUIPMENT
S2UT	06/16/87	LOW PRESSURE	EQUIPMENT
MNY	06/17/87	SOLENOID FAILURE	EQUIPMENT
ELCA	06/18/87	CANISTER NOT OPENED	OPERATOR
L1KY	06/18/87	NO PRESSURE	UNASSIGNED
MNY	06/18/87	SOLENOID FAILURE	EQUIPMENT
FWTX	06/19/87	NO EXPLANATION	UNASSIGNED
MNY	06/19/87	FITTING STRIPPED	EQUIPMENT
S1UT	06/19/87	NO EXPLANATION	UNASSIGNED
SDCA	06/19/87	CANISTER NOT OPENED	OPERATOR
MNY	06/22/87	FITTING STRIPPED	EQUIPMENT
SDCA	06/22/87	NO EXPLANATION	UNASSIGNED
SLMO	06/22/87	CANISTER LEAK	EQUIPMENT
BNY	06/24/87	ANALYSIS FAILURE	RADIAN
FWTX	06/25/87	NO PRESSURE	EQUIPMENT
S1UT	06/26/87	CANISTER NOT OPENED	OPERATOR
FRCA	06/29/87	SAMPLED ROOM AIR	OPERATOR
P1OR	06/29/87	CANISTER NOT OPENED	OPERATOR
SLMO	06/29/87	TIMER FAILURE	EQUIPMENT
DEGA	06/30/87	NO PRESSURE	EQUIPMENT
ELCA	06/30/87	SAMPLE LINE DETACHED	OPERATOR
ELCA	07/01/87	SAMPLE MANIFOLD OPEN	OPERATOR
ELTX	07/01/87	NO PRESSURE	EQUIPMENT
SDCA	07/01/87	FITTING LEAK	EQUIPMENT
ELCA	07/02/87	SAMPLE MANIFOLD OPEN	OPERATOR
MNY	07/02/87	NO EXPLANATION	UNASSIGNED
P1OR	07/02/87	LOW PRESSURE	UNASSIGNED
SLMO	07/02/87	LOW PRESSURE	EQUIPMENT
ELCA	07/06/87	SAMPLE MANIFOLD OPEN	OPERATOR
FWTX	07/07/87	POWER FAILURE-STORM	SITE
FRCA	07/08/87	NO PRESSURE	EQUIPMENT
C3IL	07/09/87	LOW PRESSURE	OPERATOR
ATGA	07/10/87	NO PRESSURE	EQUIPMENT

TABLE 2-3. 1987 NMOC STUDY, CHRONOLOGICAL INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
C3IL	07/10/87	LOW PRESSURE	OPERATOR
VICA	07/10/87	CANISTER STRIPPED	EQUIPMENT
BHAL	07/13/87	POWER FAILURE	SITE
ELTX	07/13/87	NO PRESSURE	EQUIPMENT
PICA	07/13/87	POWER FAILURE	SITE
BHAL	07/14/87	POWER FAILURE	SITE
BRLA	07/14/87	CANISTER NOT ATTACHED	OPERATOR
C3IL	07/14/87	LOW PRESSURE	OPERATOR
DLTX	07/14/87	CANISTER NOT OPENED	OPERATOR
P1OR	07/16/87	CANISTER NOT OPENED	OPERATOR
ATGA	07/17/87	OPEN BURNING	SITE
B1MA	07/17/87	NO EXPLANATION	UNASSIGNED
ATGA	07/20/87	OPEN BURNING	SITE
VICA	07/20/87	CANISTER NOT OPENED	OPERATOR
FWTX	07/21/87	NO PRESSURE	UNKNOWN
H1TX	07/22/87	CANISTER NOT OPENED	OPERATOR
S2UT	07/22/87	LOW PRESSURE	EQUIPMENT
S1UT	07/23/87	NO PRESSURE	EQUIPMENT
S2UT	07/23/87	CANISTER NOT OPENED	OPERATOR
SLMO	07/23/87	NO SAMPLE COLLECTED	SITE
C3IL	07/24/87	NO EXPLANATION	UNASSIGNED
SDCA	07/24/87	TIMER LEAD	EQUIPMENT
SDCA	07/27/87	TIMER LEAD	EQUIPMENT
B1MA	07/28/87	HIGH PRESSURE	EQUIPMENT
C1IL	07/28/87	CANISTER NOT OPENED	EQUIPMENT
MNY	07/28/87	CANISTER NOT OPENED	EQUIPMENT
S2UT	07/28/87	NO PRESSURE	EQUIPMENT
B1MA	07/29/87	HIGH PRESSURE	EQUIPMENT
B2MA	07/29/87	LOW PRESSURE	EQUIPMENT
BMTX	07/29/87	HIGH PRESSURE	EQUIPMENT
SFCA	07/29/87	SAMPLE LINE DETACHED	EQUIPMENT
B1MA	07/30/87	HIGH PRESSURE	EQUIPMENT
C3IL	07/30/87	CANISTER NOT OPENED	EQUIPMENT
DLTX	07/30/87	SIDEARM LEAK	OPERATOR
NWNJ	07/30/87	SAMPLE LINE LOOSE	OPERATOR
BNY	07/31/87	CANISTER NOT OPENED	OPERATOR
DLTX	07/31/87	SIDEARM LEAK	OPERATOR
B1MA	08/03/87	HIGH PRESSURE	EQUIPMENT
P1OR	08/03/87	NO PRESSURE	UNASSIGNED
S1UT	08/03/87	NO EXPLANATION	UNASSIGNED
S2UT	08/03/87	BROKEN LINE-ROOM AIR	EQUIPMENT
DLTX	08/04/87	EQUIPMENT LEAK	OPERATOR
L1KY	08/04/87	HIGH PRESSURE	EQUIPMENT
S2UT	08/05/87	NO PRESSURE	EQUIPMENT
S2UT	08/06/87	SOLENOID FAILURE	EQUIPMENT
FWTX	08/07/87	CANISTER NOT OPENED	EQUIPMENT
MNY	08/07/87	SOLENOID LEAK	EQUIPMENT
HTCT	08/07/87	HIGH PRESSURE	EQUIPMENT
S2UT	08/07/87	TIMER FAILURE	EQUIPMENT
HTCT	08/10/87	BROKEN FILTER ASSEMBLY	EQUIPMENT
C3IL	08/11/87	CANISTER VALVE	EQUIPMENT
ELCA	08/11/87	FAULTY ORIFICE	EQUIPMENT
HTCT	08/11/87	BROKEN LINE	EQUIPMENT
SDCA	08/11/87	SAMPLE LINE DETACHED	OPERATOR
HTCT	08/12/87	BROKEN LINE	EQUIPMENT

TABLE 2-3. 1987 NMOC STUDY, CHRONOLOGICAL INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
HTCT	08/13/87	BROKEN LINE	EQUIPMENT
L1KY	08/13/87	SAMPLE LINE DETACHED	OPERATOR
BNY	08/14/87	HIGH PRESSURE	EQUIPMENT
C3IL	08/14/87	LOW PRESSURE	EQUIPMENT
ELCA	08/14/87	LOW PRESSURE	EQUIPMENT
HTCT	08/14/87	BROKEN LINE	EQUIPMENT
S1UT	08/14/87	CANISTER NOT OPENED	EQUIPMENT
DLTX	08/17/87	SAMPLE LINE DETACHED	OPERATOR
S2UT	08/17/87	NO PRESSURE	EQUIPMENT
S2UT	08/18/87	NO PRESSURE	EQUIPMENT
C1IL	08/19/87	SOLENOID LEAK	EQUIPMENT
ELTX	08/19/87	NO PRESSURE	EQUIPMENT
S2UT	08/19/87	NO PRESSURE	EQUIPMENT
P1OR	08/20/87	NO EXPLANATION	UNASSIGNED
S2UT	08/20/87	SAMPLE LINE DETACHED	OPERATOR
VICA	08/20/87	NO EXPLANATION	UNASSIGNED
C1IL	08/21/87	SOLENOID LEAK	EQUIPMENT
S2UT	08/21/87	PUMP UNPLUGED	OPERATOR
H1TX	08/24/87	POWER FAILURE	SITE
MNY	08/24/87	HIGH PRESSURE	EQUIPMENT
S2UT	08/25/87	PLUGGED FILTER	EQUIPMENT
BACA	08/26/87	MISSED RUN	OPERATOR
P1OR	08/26/87	HIGH PRESSURE	EQUIPMENT
C1IL	08/27/87	LOW PRESSURE	EQUIPMENT
DLTX	08/27/87	NO EXPLANATION	UNASSIGNED
FWTX	08/27/87	CANISTER LOST VACUUM	OPERATOR
L1KY	08/27/87	CANISTER PARTLY OPENED	OPERATOR
S2UT	08/27/87	NO PRESSURE	EQUIPMENT
S2UT	08/28/87	SOLENOID FAILURE	EQUIPMENT
HTCT	08/31/87	HIGH PRESSURE	EQUIPMENT
S2UT	08/31/87	PUMP FAILURE	EQUIPMENT
BACA	09/01/87	POWER FAILURE	SITE
FWTX	09/01/87	SAMPLE LINE DETACHED	OPERATOR
S2UT	09/01/87	AWAITING EQUIPMENT	EQUIPMENT
BNY	09/02/87	NO EXPLANATION	UNASSIGNED
C1IL	09/02/87	POWER FAILURE	SITE
CIOH	09/02/87	CANISTER STRIPPED	EQUIPMENT
S2UT	09/02/87	NO SAMPLE - PUMP FAILURE	EQUIPMENT
VICA	09/02/87	MISSED SAMPLE	OPERATOR
B1MA	09/04/87	MISSED SAMPLE	SITE
BACA	09/04/87	MISSED SAMPLE	SITE
FRCA	09/04/87	MISSED SAMPLE	SITE
H1TX	09/04/87	MISSED SAMPLE	SITE
PICA	09/08/87	CONTAMINATION-PAINTING	SITE
S2UT	09/08/87	UNKNOWN EQUIPMENT PROBLEM	UNASSIGNED
SDCA	09/08/87	CANISTER NOT OPENED	OPERATOR
BNY	09/09/87	OPERATOR AVAILABILITY	SITE
MNY	09/09/87	OPERATOR AVAILABILITY	SITE
NWNJ	09/09/87	CANISTER NOT OPENED	OPERATOR
S2UT	09/09/87	SOLENOID FAILURE	EQUIPMENT
BNY	09/10/87	OPERATOR AVAILABILITY	SITE
MNY	09/10/87	OPERATOR AVAILABILITY	SITE
S2UT	09/10/87	SOLENOID FAILURE	EQUIPMENT
SLMO	09/10/87	SAMPLER UNPLUGGED	OPERATOR
C1IL	09/11/87	CANISTER LEAK	EQUIPMENT

TABLE 2-4. 1987 NMOC STUDY, SITE SPECIFIC INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
C1IL	06/03/87	SOLENOID FAILURE	EQUIPMENT
C1IL	06/04/87	SOLENOID FAILURE	EQUIPMENT
C1IL	06/05/87	SOLENOID FAILURE	EQUIPMENT
C1IL	06/08/87	BROKEN FILTER	EQUIPMENT
C1IL	07/28/87	CANISTER NOT OPENED	EQUIPMENT
C1IL	08/19/87	SOLENOID LEAK	EQUIPMENT
C1IL	08/21/87	SOLENOID LEAK	EQUIPMENT
C1IL	08/27/87	LOW PRESSURE	EQUIPMENT
C1IL	09/02/87	POWER FAILURE	SITE
C1IL	09/11/87	CANISTER LEAK	EQUIPMENT
C1IL	09/17/87	TIMER FAILURE	EQUIPMENT
C1IL	09/23/87	NO PRESSURE	EQUIPMENT
C3IL	06/08/87	CANISTER NOT OPENED	OPERATOR
C3IL	07/09/87	LOW PRESSURE	OPERATOR
C3IL	07/10/87	LOW PRESSURE	OPERATOR
C3IL	07/14/87	LOW PRESSURE	OPERATOR
C3IL	07/24/87	NO EXPLANATION	UNASSIGNED
C3IL	07/30/87	CANISTER NOT OPENED	EQUIPMENT
C3IL	08/11/87	CANISTER VALVE	EQUIPMENT
C3IL	08/14/87	LOW PRESSURE	EQUIPMENT
CIOH	09/02/87	CANISTER STRIPPED	EQUIPMENT
CIOH	09/28/87	SAMPLE CONTAMINATED	SITE
DEGA	06/30/87	NO PRESSURE	EQUIPMENT
DLTX	06/09/87	LOW PRESSURE	EQUIPMENT
DLTX	06/10/87	LOW PRESSURE	EQUIPMENT
DLTX	06/11/87	TIMER FAILURE	EQUIPMENT
DLTX	07/14/87	CANISTER NOT OPENED	OPERATOR
DLTX	07/30/87	SIDEARM LEAK	OPERATOR
DLTX	07/31/87	SIDEARM LEAK	OPERATOR
DLTX	08/04/87	EQUIPMENT LEAK	OPERATOR
DLTX	08/17/87	SAMPLE LINE DETACHED	OPERATOR
DLTX	08/27/87	NO EXPLANATION	UNASSIGNED
DLTX	09/11/87	NO SAMPLE CANISTER	SHIPPING
DLTX	09/16/87	CANISTER NOT OPENED	OPERATOR
ELCA	06/18/87	CANISTER NOT OPENED	OPERATOR
ELCA	06/30/87	SAMPLE LINE DETACHED	OPERATOR
ELCA	07/01/87	SAMPLE MANIFOLD OPEN	OPERATOR
ELCA	07/02/87	SAMPLE MANIFOLD OPEN	OPERATOR
ELCA	07/06/87	SAMPLE MANIFOLD OPEN	OPERATOR
ELCA	08/11/87	FAULTY ORIFICE	EQUIPMENT
ELCA	08/14/87	LOW PRESSURE	EQUIPMENT
ELTX	06/03/87	ANALYSIS FAILURE	RADIAN
ELTX	07/01/87	NO PRESSURE	EQUIPMENT
ELTX	07/13/87	NO PRESSURE	EQUIPMENT
ELTX	08/19/87	NO PRESSURE	EQUIPMENT

TABLE 2-4. 1987 NMOC STUDY, SITE SPECIFIC INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
ELTX	09/14/87	NO EXPLANATION	UNASSIGNED
ELTX	09/15/87	NO EXPLANATION	UNASSIGNED
FRCA	06/29/87	SAMPLED ROOM AIR	OPERATOR
FRCA	07/08/87	NO PRESSURE	EQUIPMENT
FRCA	09/04/87	MISSED SAMPLE	SITE
FRCA	09/17/87	NO EXPLANATION	UNASSIGNED
FWTX	06/19/87	NO EXPLANATION	UNASSIGNED
FWTX	06/25/87	NO PRESSURE	EQUIPMENT
FWTX	07/07/87	POWER FAILURE-STORM	SITE
FWTX	07/21/87	NO PRESSURE	UNKNOWN
FWTX	08/07/87	CANISTER NOT OPENED	EQUIPMENT
FWTX	08/27/87	CANISTER LOST VACUUM	OPERATOR
FWTX	09/01/87	SAMPLE LINE DETACHED	OPERATOR
FWTX	09/24/87	TIMER ELECTRICAL FAILURE	EQUIPMENT
H1TX	07/22/87	CANISTER NOT OPENED	OPERATOR
H1TX	08/24/87	POWER FAILURE	SITE
H1TX	09/04/87	MISSED SAMPLE	SITE
H1TX	09/11/87	NO EXPLANATION	UNASSIGNED
H1TX	09/16/87	SAMPLE LINE BROKEN	EQUIPMENT
HTCT	08/07/87	HIGH PRESSURE	EQUIPMENT
HTCT	08/10/87	BROKEN FILTER ASSEMBLY	EQUIPMENT
HTCT	08/11/87	BROKEN LINE	EQUIPMENT
HTCT	08/12/87	BROKEN LINE	EQUIPMENT
HTCT	08/13/87	BROKEN LINE	EQUIPMENT
HTCT	08/14/87	BROKEN LINE	EQUIPMENT
HTCT	08/31/87	HIGH PRESSURE	EQUIPMENT
L1KY	06/10/87	CANISTER NOT OPENED	OPERATOR
L1KY	06/18/87	NO PRESSURE	UNASSIGNED
L1KY	08/04/87	HIGH PRESSURE	EQUIPMENT
L1KY	08/13/87	SAMPLE LINE DETACHED	OPERATOR
L1KY	08/27/87	CANISTER PARTLY OPENED	OPERATOR
L1KY	09/17/87	CANISTER NOT OPENED	OPERATOR
L1KY	09/28/87	NO EXPLANATION	UNASSIGNED
LVTX	06/13/87	POWER FAILURE	SITE
LVTX	09/25/87	BROKEN FILTER	EQUIPMENT
MNY	06/12/87	FITTING STRIPPED	OPERATOR
MNY	06/15/87	SOLENOID LEAK	EQUIPMENT
MNY	06/16/87	SOLENOID LEAK	EQUIPMENT
MNY	06/17/87	SOLENOID FAILURE	EQUIPMENT
MNY	06/18/87	SOLENOID FAILURE	EQUIPMENT
MNY	06/19/87	FITTING STRIPPED	EQUIPMENT
MNY	06/22/87	FITTING STRIPPED	EQUIPMENT
MNY	07/02/87	NO EXPLANATION	UNASSIGNED
MNY	07/28/87	CANISTER NOT OPENED	EQUIPMENT

TABLE 2-4. 1987 NMOC STUDY, SITE SPECIFIC INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
MNY	08/07/87	SOLENOID LEAK	EQUIPMENT
MNY	08/24/87	HIGH PRESSURE	EQUIPMENT
MNY	09/09/87	OPERATOR AVAILABILITY	SITE
MNY	09/10/87	OPERATOR AVAILABILITY	SITE
MNY	09/24/87	SCHOOL HOLIDAY	SITE
MNY	09/25/87	SCHOOL HOLIDAY	SITE
MNY	09/28/87	SCHOOL HOLIDAY	SITE
NWNJ	07/30/87	SAMPLE LINE LOOSE	OPERATOR
NWNJ	09/09/87	CANISTER NOT OPENED	OPERATOR
P1OR	06/29/87	CANISTER NOT OPENED	OPERATOR
P1OR	07/02/87	LOW PRESSURE	UNASSIGNED
P1OR	07/16/87	CANISTER NOT OPENED	OPERATOR
P1OR	08/03/87	NO PRESSURE	UNASSIGNED
P1OR	08/20/87	NO EXPLANATION	UNASSIGNED
P1OR	08/26/87	HIGH PRESSURE	EQUIPMENT
P1OR	09/14/87	NO EXPLANATION	UNASSIGNED
P1OR	09/21/87	LOW PRESSURE	EQUIPMENT
PICA	07/13/87	POWER FAILURE	SITE
PICA	09/08/87	CONTAMINATION-PAINTING	SITE
PICA	09/11/87	NO EXPLANATION	UNASSIGNED
PICA	10/12/87	NO EXPLANATION	UNASSIGNED
PICA	10/21/87	OPERATOR AVAILABILITY	SITE
S1UT	06/19/87	NO EXPLANATION	UNASSIGNED
S1UT	06/26/87	CANISTER NOT OPENED	OPERATOR
S1UT	07/23/87	NO SAMPLE PRESSURE	EQUIPMENT
S1UT	08/03/87	NO EXPLANATION	UNASSIGNED
S1UT	08/14/87	CANISTER NOT OPENED	EQUIPMENT
S1UT	09/11/87	CANISTER NOT OPENED	OPERATOR
S1UT	09/15/87	NO EXPLANATION	UNASSIGNED
S1UT	09/17/87	NO EXPLANATION	UNASSIGNED
S1UT	09/22/87	UNKNOWN FAILURE	EQUIPMENT
S1UT	09/23/87	BROKEN SIDEARM	EQUIPMENT
S1UT	09/28/87	NO EXPLANATION	EQUIPMENT
S1UT	09/30/87	NO EXPLANATION	EQUIPMENT
S2UT	06/04/87	CANISTER NOT OPENED	OPERATOR
S2UT	06/16/87	LOW PRESSURE	EQUIPMENT
S2UT	07/22/87	LOW PRESSURE	EQUIPMENT
S2UT	07/23/87	CANISTER NOT OPENED	OPERATOR
S2UT	07/28/87	NO PRESSURE	EQUIPMENT
S2UT	08/03/87	BROKEN LINE-ROOM AIR	EQUIPMENT
S2UT	08/05/87	NO PRESSURE	EQUIPMENT
S2UT	08/06/87	SOLENOID FAILURE	EQUIPMENT
S2UT	08/07/87	TIMER FAILURE	EQUIPMENT
S2UT	08/17/87	NO PRESSURE	EQUIPMENT
S2UT	08/18/87	NO PRESSURE	EQUIPMENT
S2UT	08/19/87	NO PRESSURE	EQUIPMENT

TABLE 2-4. 1987 NMOC STUDY, SITE SPECIFIC INVALIDATED AND MISSING SAMPLES

SITE	DATE	DESCRIPTION	ASSIGNED
S2UT	08/20/87	SAMPLE LINE DETACHED	OPERATOR
S2UT	08/21/87	PUMP UNPLUGED	OPERATOR
S2UT	08/25/87	PLUGGED FILTER	EQUIPMENT
S2UT	08/27/87	NO PRESSURE	EQUIPMENT
S2UT	08/28/87	SOLENOID FAILURE	EQUIPMENT
S2UT	08/31/87	PUMP FAILURE	EQUIPMENT
S2UT	09/01/87	AWAITING EQUIPMENT	EQUIPMENT
S2UT	09/02/87	NO SAMPLE - PUMP FAILURE	EQUIPMENT
S2UT	09/08/87	UNKNOWN EQUIPMENT PROBLEM	UNASSIGNED
S2UT	09/09/87	SOLENOID FAILURE	EQUIPMENT
S2UT	09/10/87	SOLENOID FAILURE	EQUIPMENT
S2UT	09/11/87	TIMER LATE	EQUIPMENT
S2UT	09/14/87	TIMER/SOLENOID FAILURE	EQUIPMENT
S2UT	09/15/87	TIMER/SOLENOID FAILURE	EQUIPMENT
S2UT	09/17/87	NO EXPLANATION	UNASSIGNED
S2UT	09/21/87	LOW PRESSURE	EQUIPMENT
S2UT	09/22/87	LOW PRESSURE	EQUIPMENT
SDCA	06/03/87	CANISTER PRESSURE	EQUIPMENT
SDCA	06/04/87	CANISTER PRESSURE	EQUIPMENT
SDCA	06/19/87	CANISTER NOT OPENED	OPERATOR
SDCA	06/22/87	NO EXPLANATION	UNASSIGNED
SDCA	07/01/87	FITTING LEAK	EQUIPMENT
SDCA	07/24/87	TIMER LEAD	EQUIPMENT
SDCA	07/27/87	TIMER LEAD	EQUIPMENT
SDCA	08/11/87	SAMPLE LINE DETACHED	OPERATOR
SDCA	09/08/87	CANISTER NOT OPENED	OPERATOR
SDCA	09/28/87	NO PRESSURE	EQUIPMENT
SFCA	07/29/87	SAMPLE LINE DETACHED	EQUIPMENT
SLMO	06/22/87	CANISTER LEAK	EQUIPMENT
SLMO	06/29/87	TIMER FAILURE	EQUIPMENT
SLMO	07/02/87	LOW SAMPLE PRESSURE	EQUIPMENT
SLMO	07/23/87	NO SAMPLE COLLECTED	SITE
SLMO	09/10/87	SAMPLER UNPLUGGED	OPERATOR
SLMO	09/17/87	NO SAMPLE COLLECTED	SITE
VICA	06/15/87	MISSED SAMPLE	OPERATOR
VICA	07/10/87	CANISTER STRIPPED	EQUIPMENT
VICA	07/20/87	CANISTER NOT OPENED	OPERATOR
VICA	08/20/87	NO EXPLANATION	UNASSIGNED
VICA	09/02/87	MISSED SAMPLE	OPERATOR
VICA	09/22/87	NO EXPLANATION	UNKNOWN
VICA	09/23/87	CANISTER NOT OPENED	OPERATOR

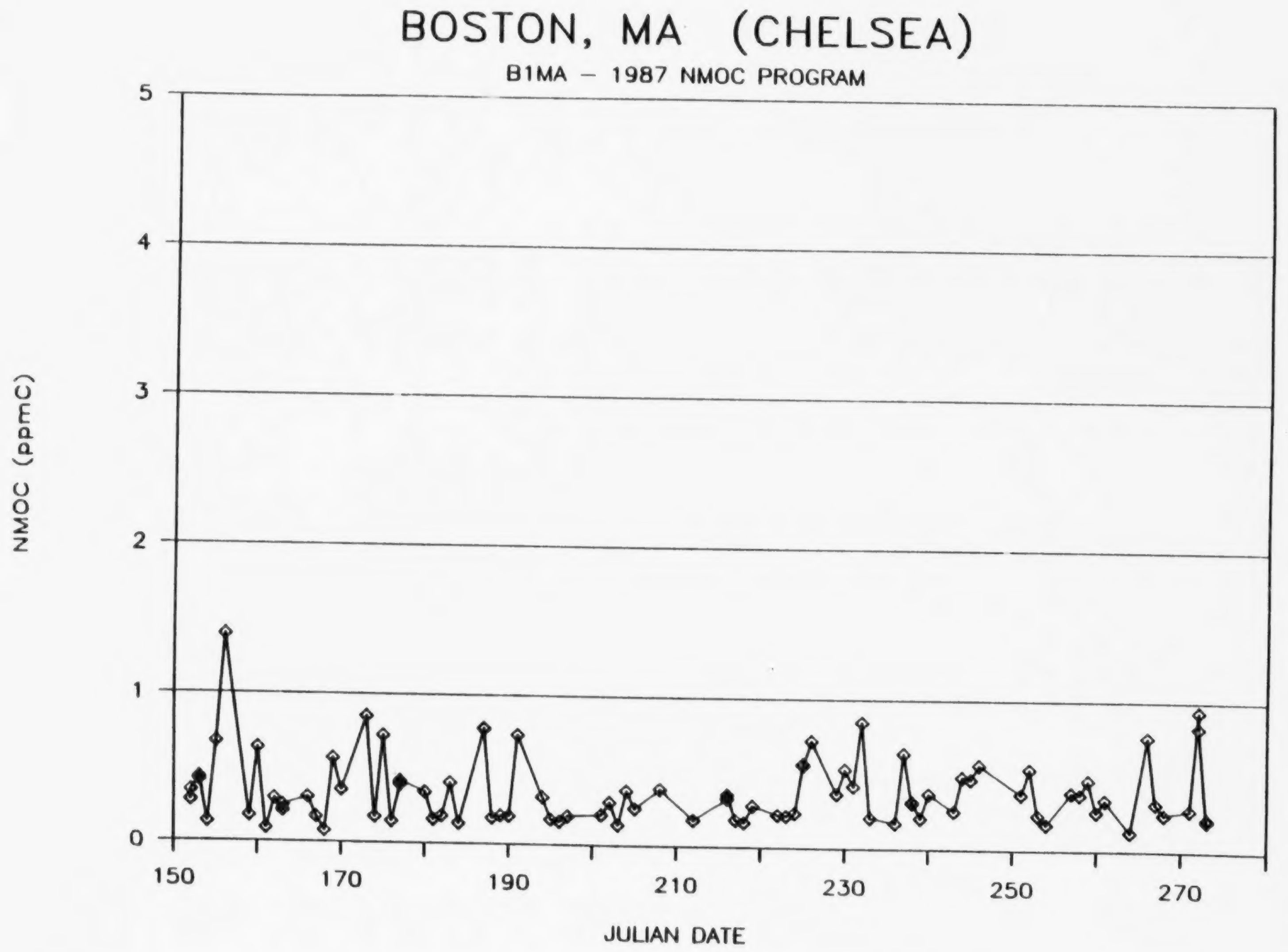

Figure 2-1. Plot of NMOC concentration for Boston, MA (Chelsea).

TABLE 2-5. SUMMARY OF THE 1987 NMOC DATA FOR BOSTON, MA (B1MA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1008	32	B	0.277		
06/01/87	152	M	1009	151	C	0.346		
06/02/87	153	T	1012	150	C	0.416		
06/02/87	153	T	1012	150	B	0.436		
06/03/87	154	W	1044	79	A	0.136		
06/04/87	155	H	1067	73	B	0.674		
06/05/87	156	F	1086	52	A	1.397		
06/08/87	159	M	1118	138	D	0.176		
06/09/87	160	T	1155	677	D	0.634		
06/10/87	161	W	1164	182	A	0.093		
06/11/87	162	H	1199	191	C	0.295	0.332	0.258
06/12/87	163	F	1217	302	A	0.214		
06/12/87	163	F	1217	302	B	0.250		
06/15/87	166	M	1280	100	C	0.307		
06/16/87	167	T	1294	659	B	0.173	0.242	0.153
06/17/87	168	W	1320	151	C	0.078		
06/18/87	169	H	1343	668	C	0.567	0.586	0.464
06/19/87	170	F	1381	191	D	0.356		
06/22/87	173	M	1430	99	C	0.851		
06/23/87	174	T	1442	71	A	0.176		
06/24/87	175	W	1477	181	B	0.722		
06/25/87	176	H	1556	103	B	0.150		
06/26/87	177	F	1560	90	A	0.395		
06/26/87	177	F	1561	149	A	0.422		
06/29/87	180	M	1583	89	A	0.346		
06/30/87	181	T	1642	723	D	0.164		
07/01/87	182	W	1621	686	C	0.188		
07/02/87	183	H	1668	656	C	0.409		
07/03/87	184	F	1693	150	D	0.139		
07/06/87	187	M	1714	501	A	0.778		
07/06/87	187	M	1714	501	A	0.773		
07/07/87	188	T	1741	179	B	0.176		0.156
07/08/87	189	W	1813	172	B	0.193		
07/09/87	190	H	1826	682	B	0.190		
07/10/87	191	F	1858	711	D	0.733		
07/13/87	194	M	1894	143	D	0.319		
07/14/87	195	T	1909	698	A	0.170		
07/15/87	196	W	1947	43	D	0.157		
07/16/87	197	H	1984	725	B	0.198		
07/16/87	197	H	1986	180	C	0.198		
07/20/87	201	M	2084	140	C	0.207	0.223	0.156
07/21/87	202	T	2078	669	D	0.291		
07/22/87	203	W	2120	24	A	0.140		

TABLE 2-5. SUMMARY OF THE 1987 NMOC DATA FOR BOSTON, MA (B1MA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/23/87	204	H	2153	70	C	0.370		
07/24/87	205	F	2162	14	D	0.254		
07/27/87	208	M	2215	158	D	0.384		0.380
07/31/87	212	F	2336	72	B	0.180		
08/04/87	216	T	2418	766	D	0.328		
08/04/87	216	T	2423	769	D	0.358		
08/05/87	217	W	2434	636	D	0.185	0.247	0.248
08/06/87	218	H	2513	197	B	0.169		
08/07/87	219	F	2511	692	A	0.280		
08/10/87	222	M	2552	625	A	0.222		
08/11/87	223	T	2583	156	B	0.217		
08/12/87	224	W	2619	766	A	0.237		
08/13/87	225	H	2623	104	D	0.566		
08/13/87	225	H	2623	104	A	0.557		
08/14/87	226	F	2657	715	D	0.720		
08/17/87	229	M	2730	123	A	0.367		
08/18/87	230	T	2726	100	B	0.530		
08/19/87	231	W	2782	19	C	0.422		
08/20/87	232	H	2791	130	B	0.849		
08/21/87	233	F	2821	674	D	0.212		
08/24/87	236	M	2897	86	B	0.177		
08/25/87	237	T	2930	791	C	0.640		
08/26/87	238	W	2907	789	A	0.312		0.324
08/26/87	238	W	2908	768	A	0.324		0.336
08/27/87	239	H	2983	53	D	0.211		
08/28/87	240	F	2998	730	B	0.374		
08/31/87	243	M	3056	657	C	0.259		
09/01/87	244	T	3077	710	A	0.485		
09/02/87	245	W	3113	112	C	0.472		
09/03/87	246	H	3164	89	C	0.567		
09/08/87	251	T	3229	779	C	0.377		
09/09/87	252	W	3266	675	A	0.541		
09/10/87	253	H	3280	640	D	0.236		
09/11/87	254	F	3313	781	A	0.178		0.141
09/14/87	257	M	3353	645	C	0.391		
09/14/87	257	M	3354	689	C	0.388		
09/15/87	258	T	3394	785	A	0.377		
09/16/87	259	W	3410	75	D	0.471		0.489
09/17/87	260	H	3452	692	D	0.261		
09/18/87	261	F	3455	83	C	0.343		
09/21/87	264	M	3502	196	C	0.129		0.104
09/23/87	266	W	3594	764	C	0.760		
09/24/87	267	H	3662	795	A	0.321		

TABLE 2-5. SUMMARY OF THE 1987 NMOC DATA FOR BOSTON, MA (B1MA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/25/87	268	F	3642	191	D	0.248		
09/28/87	271	M	3694	141	A	0.280		0.239
09/29/87	272	T	3710	147	D	0.938		
09/29/87	272	T	3710	147	A	0.830		
09/30/87	273	W	3807	194	C	0.212		
09/30/87	273	W	3808	667	D	0.226		

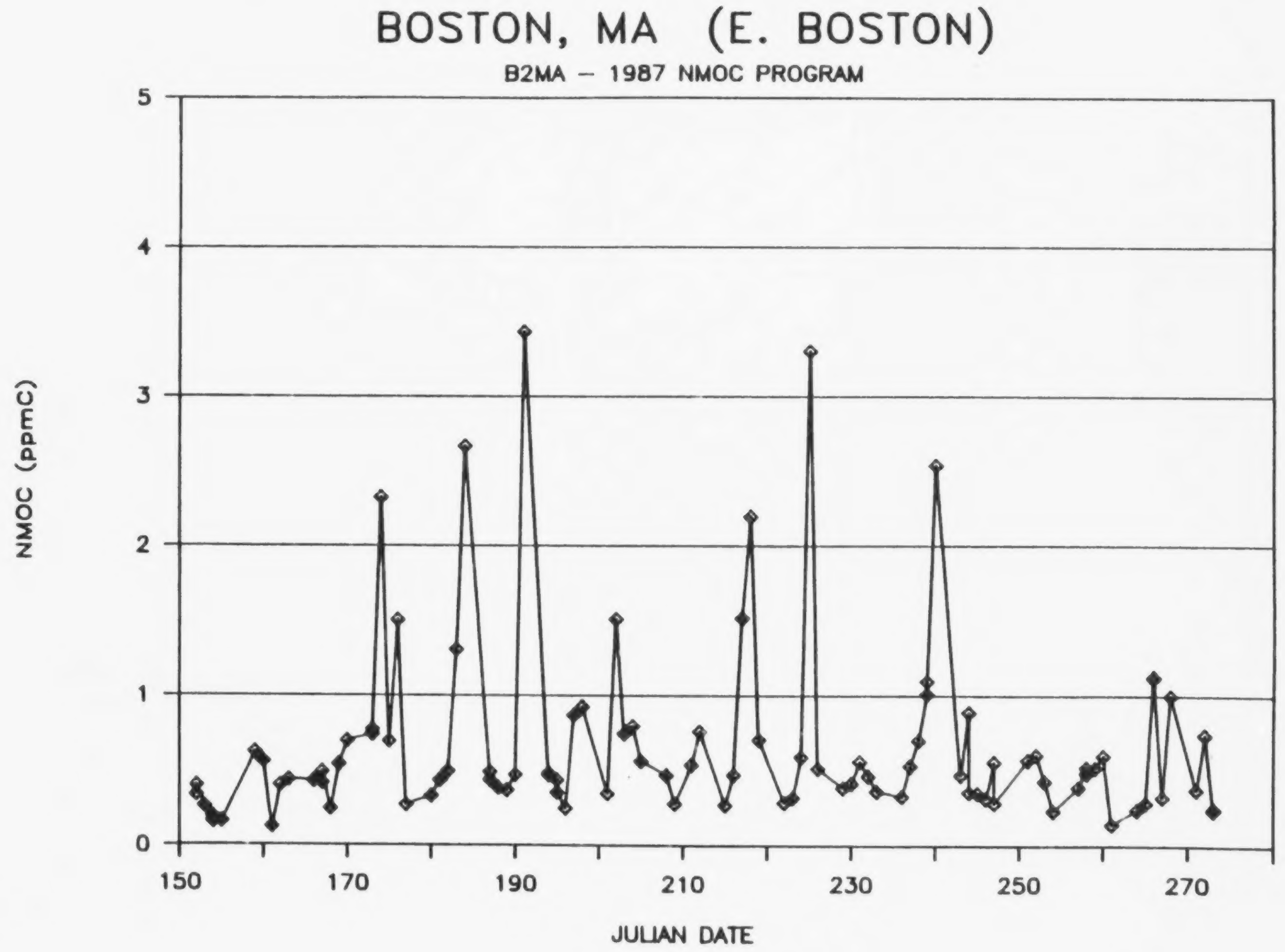

Figure 2-2. Plot of NMOC concentration for Boston, MA (E. Boston).

TABLE 2-6. SUMMARY OF THE 1987 NMOC DATA FOR BOSTON, MA (B2MA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1006	178	C	0.334		
06/01/87	152	M	1005	93	B	0.399		
06/02/87	153	T	1015	197	A	0.259	0.315	0.265
06/03/87	154	W	1032	106	A	0.190		
06/03/87	154	W	1032	106	C	0.156		
06/04/87	155	H	1055	10	B	0.159		0.166
06/08/87	159	M	1124	137	C	0.620		
06/09/87	160	T	1156	666	B	0.558		
06/10/87	161	W	1163	79	B	0.123		
06/11/87	162	H	1202	42	B	0.401		
06/12/87	163	F	1219	66	A	0.438		
06/15/87	166	M	1279	101	D	0.430		
06/16/87	167	T	1286	80	D	0.417		
06/16/87	167	T	1286	80	C	0.489		
06/17/87	168	W	1319	70	B	0.244		
06/18/87	169	H	1346	1	D	0.539		
06/19/87	170	F	1380	60	C	0.698		
06/22/87	173	M	1431	82	B	0.740		
06/22/87	173	M	1432	72	D	0.772		
06/23/87	174	T	1450	185	C	2.323		
06/24/87	175	W	1476	43	A	0.694		
06/25/87	176	H	1552	309	B	1.507		
06/26/87	177	F	1538	730	B	0.271		
06/29/87	180	M	1584	169	B	0.330		
06/30/87	181	T	1641	659	D	0.433		
07/01/87	182	W	1620	193	A	0.494		
07/02/87	183	H	1671	178	B	1.308		
07/03/87	184	F	1697	711	D	2.665		
07/06/87	187	M	1715	678	C	0.488		
07/06/87	187	M	1715	678	A	0.436		
07/07/87	188	T	1740	188	C	0.384	0.386	0.457
07/08/87	189	W	1812	82	D	0.367		
07/09/87	190	H	1827	12	B	0.472		
07/10/87	191	F	1867	102	B	3.433		
07/13/87	194	M	1873	25	D	0.468		
07/13/87	194	M	1873	25	B	0.482		
07/14/87	195	T	1902	661	D	0.436		
07/14/87	195	T	1902	661	C	0.350		
07/15/87	196	W	1948	155	A	0.247		
07/16/87	197	H	2034	12	D	0.867		
07/17/87	198	F	2031	711	B	0.925		
07/17/87	198	F	2032	95	D	0.924		
07/20/87	201	M	2071	729	B	0.346		

TABLE 2-6. SUMMARY OF THE 1987 NMOC DATA FOR BOSTON, MA (B2MA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/21/87	202	T	2070	306	B	1.511		
07/22/87	203	W	2119	154	B	0.745		
07/23/87	204	H	2156	694	C	0.794		
07/24/87	205	F	2163	682	C	0.562		
07/27/87	208	M	2216	707	C	0.469	0.358	0.314
07/28/87	209	T	2250	24	D	0.279		
07/30/87	211	H	2302	149	A	0.536		
07/31/87	212	F	2369	70	D	0.759		
08/03/87	215	M	2378	191	B	0.271	0.351	0.228
08/04/87	216	T	2400	707	A	0.472		
08/05/87	217	W	2432	121	A	1.521	1.574	1.603
08/05/87	217	W	2433	135	A	1.522		
08/06/87	218	H	2518	51	B	2.193		
08/07/87	219	F	2510	19	C	0.706		
08/10/87	222	M	2549	635	C	0.287		
08/11/87	223	T	2602	95	D	0.319		
08/12/87	224	W	2607	38	B	0.591		
08/13/87	225	H	2632	74	A	3.302	3.401	
08/14/87	226	F	2662	108	C	0.515		
08/17/87	229	M	2727	637	B	0.384		
08/18/87	230	T	2714	640	C	0.416	0.444	
08/19/87	231	W	2792	633	C	0.559		
08/20/87	232	H	2778	42	B	0.463		
08/21/87	233	F	2832	37	B	0.362		
08/24/87	236	M	2886	106	C	0.329		
08/25/87	237	T	2937	800	D	0.531		
08/26/87	238	W	2913	680	C	0.699		
08/27/87	239	H	3028	30	B	1.010		
08/27/87	239	H	3029	764	D	1.098		
08/28/87	240	F	2999	151	A	2.537		
08/31/87	243	M	3060	775	C	0.472		
09/01/87	244	T	3073	781	A	0.889		
09/01/87	244	T	3073	781	B	0.357		
09/02/87	245	W	3112	73	C	0.351		
09/03/87	246	H	3141	791	C	0.316		
09/04/87	247	F	3166	12	C	0.555		
09/04/87	247	F	3153	780	B	0.284	0.348	
09/08/87	251	T	3222	171	A	0.569		0.590
09/09/87	252	W	3262	302	A	0.605		
09/10/87	253	H	3279	618	D	0.431		
09/11/87	254	F	3320	114	B	0.232		0.198
09/14/87	257	M	3364	113	D	0.390		
09/15/87	258	T	3400	24	C	0.522		

TABLE 2-6. SUMMARY OF THE 1987 NMOC DATA FOR BOSTON, MA (B2MA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/15/87	258	T	3401	120	D	0.482		
09/16/87	259	W	3412	684	B	0.519		0.509
09/17/87	260	H	3486	42	A	0.597		
09/18/87	261	F	3489	93	C	0.142		
09/21/87	264	M	3504	143	C	0.241		0.270
09/22/87	265	T	3509	114	A	0.286		
09/22/87	265	T	3509	114	A	0.287		
09/23/87	266	W	3604	122	B	1.122		
09/23/87	266	W	3603	790	B	1.129		
09/24/87	267	H	3630	704	A	0.325		
09/25/87	268	F	3635	93	B	1.001		
09/28/87	271	M	3700	711	C	0.376		0.327
09/29/87	272	T	3724	643	B	0.739		
09/30/87	273	W	3801	91	C	0.240		
09/30/87	273	W	3802	61	D	0.249		

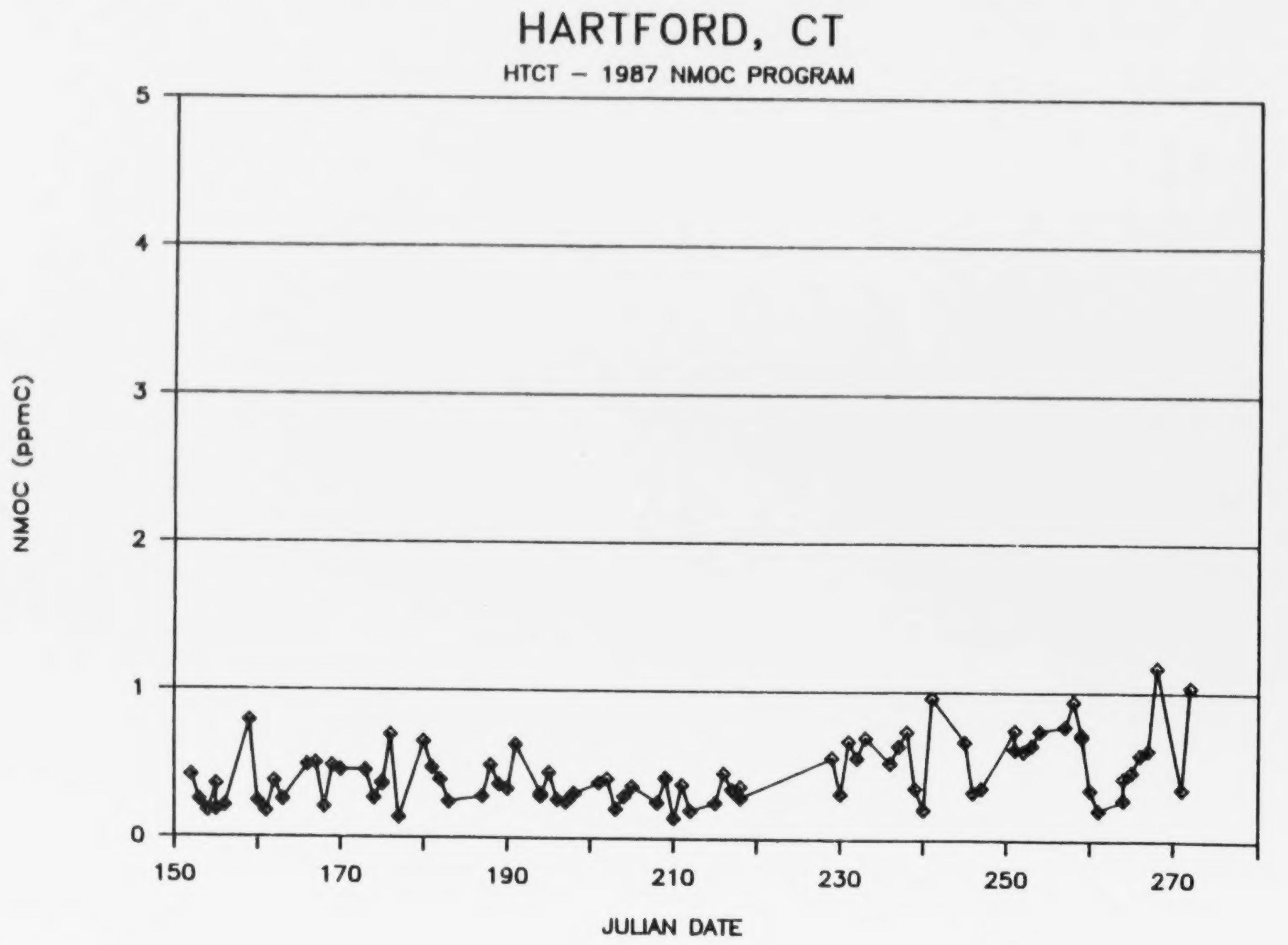

Figure 2-3. Plot of NMOC concentration for Hartford, CT.

TABLE 2-7. SUMMARY OF THE 1987 NMOC DATA FOR HARTFORD, CT (HTCT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1047	90	D	0.419		
06/02/87	153	T	1048	96	A	0.250		
06/03/87	154	W	1073	35	C	0.178		
06/04/87	155	H	1064	42	A	0.357		
06/04/87	155	H	1065	198	B	0.185		
06/05/87	156	F	1077	133	B	0.212		
06/08/87	159	M	1136	668	C	0.788		0.834
06/09/87	160	T	1162	38	B	0.243		
06/10/87	161	W	1193	8	A	0.177	0.243	0.142
06/11/87	162	H	1254	401	A	0.380		
06/12/87	163	F	1274	73	D	0.255		
06/15/87	166	M	1288	68	A	0.492		0.413
06/16/87	167	T	1349	194	C	0.504		
06/17/87	168	W	1351	410	D	0.208		
06/18/87	169	H	1364	126	A	0.487		
06/19/87	170	F	1453	500	B	0.459		
06/22/87	173	M	1456	676	D	0.454		
06/23/87	174	T	1487	193	D	0.268		
06/24/87	175	W	1509	186	C	0.374		
06/24/87	175	W	1510	77	D	0.363		
06/25/87	176	H	1544	129	D	0.698		
06/26/87	177	F	1571	179	C	0.137		
06/29/87	180	M	1660	9	C	0.651		
06/30/87	181	T	1609	400	C	0.475	0.384	0.227
07/01/87	182	W	1662	676	D	0.393		
07/02/87	183	H	1764	409	C	0.243		
07/06/87	187	M	1747	691	D	0.282		
07/07/87	188	T	1771	194	C	0.492	0.378	0.374
07/08/87	189	W	1806	122	C	0.363		
07/09/87	190	H	1887	41	D	0.333	0.359	0.331
07/10/87	191	F	1886	154	C	0.633		0.448
07/13/87	194	M	1907	3	A	0.303		
07/13/87	194	M	1908	136	C	0.285		
07/14/87	195	T	1935	55	D	0.445		0.181
07/15/87	196	W	2026	153	C	0.262		
07/16/87	197	H	2033	405	C	0.245		
07/17/87	198	F	2054	176	C	0.306		
07/17/87	198	F	2054	176	B	0.301		
07/20/87	201	M	2076	401	D	0.376		
07/21/87	202	T	2139	166	A	0.404		
07/22/87	203	W	2134	105	A	0.200	0.189	0.170
07/23/87	204	H	2204	32	A	0.287		
07/24/87	205	F	2220	77	C	0.355		

TABLE 2-7. SUMMARY OF THE 1987 NMOC DATA FOR HARTFORD, CT (HTCT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/27/87	208	M	2239	171	D	0.245		
07/28/87	209	T	2259	176	A	0.408		
07/28/87	209	T	2259	176	A	0.413		
07/29/87	210	W	2300	630	C	0.141		
07/30/87	211	H	2324	187	C	0.366		
07/31/87	212	F	2376	103	C	0.191	0.292	0.177
08/03/87	215	M	2399	32	A	0.244	0.330	0.200
08/04/87	216	T	2446	768	C	0.445		
08/05/87	217	W	2480	56	B	0.334		
08/06/87	218	H	2495	720	D	0.353		
08/06/87	218	H	2528	17	B	0.279		
08/17/87	229	M	2711	669	A	0.553	0.552	
08/18/87	230	T	2734	3	C	0.310		
08/19/87	231	W	2790	656	D	0.664		
08/20/87	232	H	2868	722	C	0.551		
08/21/87	233	F	2914	655	D	0.689		
08/24/87	236	M	2929	658	A	0.518		
08/25/87	237	T	2916	779	D	0.632		
08/26/87	238	W	2988	47	B	0.729		
08/27/87	239	H	2993	630	A	0.348		
08/28/87	240	F	3030	162	C	0.205		
08/28/87	240	F	3031	61	C	0.205		
09/01/87	241	T	3115	41	B	0.959		
09/02/87	245	W	3173	782	D	0.664		
09/03/87	246	H	3163	156	C	0.324		
09/04/87	247	F	3201	37	D	0.350		
09/08/87	251	T	3253	82	D	0.741		
09/08/87	251	T	3253	82	B	0.616		
09/09/87	252	W	3303	91	D	0.601		
09/10/87	253	H	3298	637	B	0.642		0.684
09/11/87	254	F	3318	15	C	0.738		
09/14/87	257	M	3380	7	B	0.769		
09/15/87	258	T	3415	406	C	0.937		0.972
09/16/87	259	W	3493	695	D	0.717		
09/16/87	259	W	3492	109	D	0.700		
09/17/87	260	H	3447	122	C	0.342		
09/18/87	261	F	3526	658	D	0.206		
09/21/87	264	M	3543	74	D	0.278		
09/21/87	264	M	3543	74	C	0.422		
09/22/87	265	T	3593	187	A	0.467		
09/23/87	266	W	3621	146	A	0.578		
09/24/87	267	H	3627	160	D	0.611		
09/25/87	268	F	3718	634	B	1.170		

TABLE 2-7. SUMMARY OF THE 1987 NMOC DATA FOR HARTFORD, CT (HTCT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/28/87	271	M	3722	78	B	0.351		
09/29/87	272	T	3716	8	D	1.038		

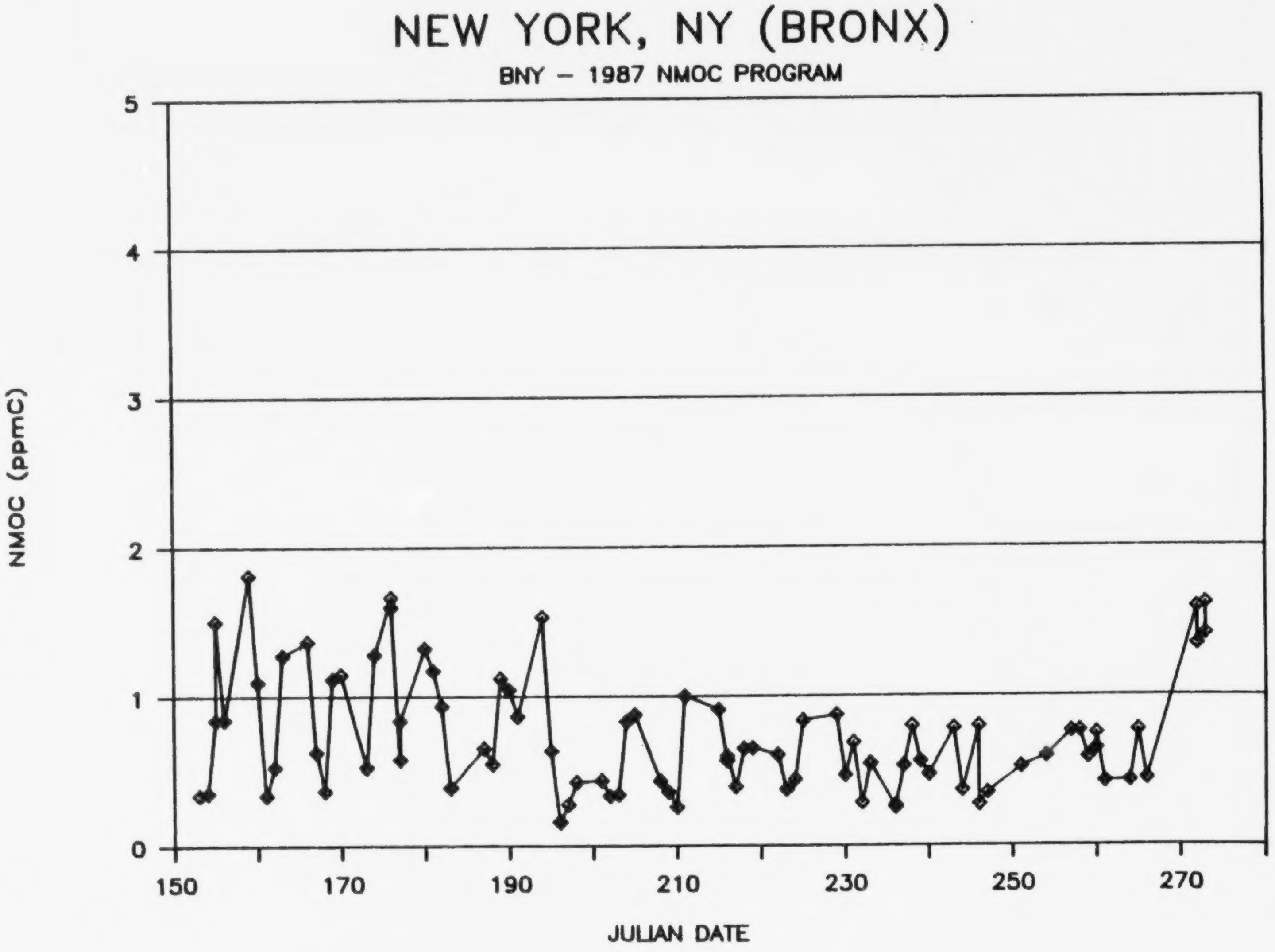

Figure 2-4. Plot of NMOC concentration for New York, NY (Bronx).

TABLE 2-8. SUMMARY OF THE 1987 NMOC DATA FOR NEW YORK, NY (BNY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/02/87	153	T	1046	187	D	0.342		
06/03/87	154	W	1043	19	B	0.358		
06/04/87	155	H	1056	111	C	0.843		0.687
06/04/87	155	H	1057	169	D	1.502		
06/05/87	156	F	1114	120	A	0.846		
06/08/87	159	M	1142	309	C	1.812		
06/09/87	160	T	1184	184	C	1.097		
06/10/87	161	W	1183	21	C	0.341		
06/11/87	162	H	1221	44	B	0.529		
06/12/87	163	F	1220	644	A	1.275		
06/15/87	166	M	1262	84	D	1.369	1.049	1.060
06/16/87	167	T	1290	182	C	0.629	0.636	0.547
06/17/87	168	W	1327	156	A	0.371		
06/18/87	169	H	1353	660	B	1.117		
06/19/87	170	F	1389	130	D	1.150		0.900
06/22/87	173	M	1425	400	A	0.528		
06/23/87	174	T	1449	308	C	1.282		
06/25/87	176	H	1558	6	D	1.665		
06/25/87	176	H	1559	171	D	1.597		
06/26/87	177	F	1569	678	A	0.579		
06/26/87	177	F	1569	678	D	0.837		
06/29/87	180	M	1602	668	D	1.324		
06/30/87	181	T	1595	44	C	1.175		0.898
07/01/87	182	W	1646	44	B	0.935		
07/02/87	183	H	1688	687	D	0.392		
07/02/87	183	H	1688	687	D	0.390		
07/06/87	187	M	1716	28	B	0.652		0.561
07/07/87	188	T	1746	130	A	0.548		
07/08/87	189	W	1801	650	D	1.120		
07/09/87	190	H	1882	184	A	1.044		
07/10/87	191	F	1869	7	B	0.865		
07/13/87	194	M	1889	306	C	1.532	1.330	1.490
07/14/87	195	T	1953	157	C	0.634		
07/15/87	196	W	1962	170	B	0.167		
07/15/87	196	W	1963	47	B	0.160		
07/16/87	197	H	1999	31	D	0.279		
07/17/87	198	F	2042	727	A	0.426		
07/20/87	201	M	2051	697	A	0.439		
07/21/87	202	T	2099	104	A	0.333	0.348	0.270
07/22/87	203	W	2130	73	B	0.345		
07/23/87	204	H	2170	410	D	0.831		
07/24/87	205	F	2184	646	A	0.877		
07/27/87	208	M	2218	135	D	0.435		0.368

TABLE 2-8. SUMMARY OF THE 1987 NMOC DATA FOR NEW YORK, NY (BNY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/28/87	209	T	2278	17	B	0.361		
07/29/87	210	W	2281	677	D	0.261		
07/30/87	211	H	2338	709	A	1.001		
08/03/87	215	M	2424	182	B	0.911		
08/04/87	216	T	2395	770	D	0.567		
08/04/87	216	T	2395	770	B	0.599		
08/05/87	217	W	2449	90	B	0.397	0.398	
08/06/87	218	H	2494	782	D	0.649		
08/07/87	219	F	2529	150	C	0.652		
08/10/87	222	M	2569	181	C	0.607		
08/11/87	223	T	2605	659	A	0.376		
08/12/87	224	W	2595	769	D	0.445		
08/13/87	225	H	2699	143	D	0.835		
08/17/87	229	M	2732	53	B	0.874		
08/18/87	230	T	2761	302	A	0.471		
08/19/87	231	W	2775	683	C	0.689	0.620	
08/20/87	232	H	2841	50	A	0.287		
08/21/87	233	F	2817	782	C	0.546		
08/21/87	233	F	2817	782	C	0.548		
08/24/87	236	M	2905	704	A	0.256		
08/24/87	236	M	2906	697	D	0.269		
08/25/87	237	T	2933	707	A	0.534		
08/26/87	238	W	2964	307	D	0.798		
08/27/87	239	H	2984	682	D	0.561		
08/28/87	240	F	2992	703	C	0.476		
08/31/87	243	M	3040	699	D	0.780		
09/01/87	244	T	3091	96	C	0.370		
09/03/87	246	H	3116	148	B	0.794		
09/03/87	246	H	3156	13	C	0.275		
09/04/87	247	F	3187	75	A	0.354		
09/08/87	251	T	3406	401	D	0.524		
09/11/87	254	F	3408	726	A	0.596		
09/14/87	257	M	3422	772	C	0.760		
09/15/87	258	T	3438	674	C	0.763		
09/16/87	259	W	3430	35	B	0.588		
09/17/87	260	H	3540	147	A	0.647		
09/17/87	260	H	3541	192	A	0.747		
09/18/87	261	F	3512	115	B	0.428		0.388
09/21/87	264	M	3577	302	B	0.433		
09/22/87	265	T	3585	72	D	0.766		
09/23/87	266	W	3598	162	A	0.447		
09/29/87	272	T	3741	647	A	1.591		
09/29/87	272	T	3742	712	A	1.344		

TABLE 2-8. SUMMARY OF THE 1987 NMOC DATA FOR NEW YORK, NY (BNY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/30/87	273	W	3770	46	A	1.412		
09/30/87	273	W	3771	679	B	1.616		

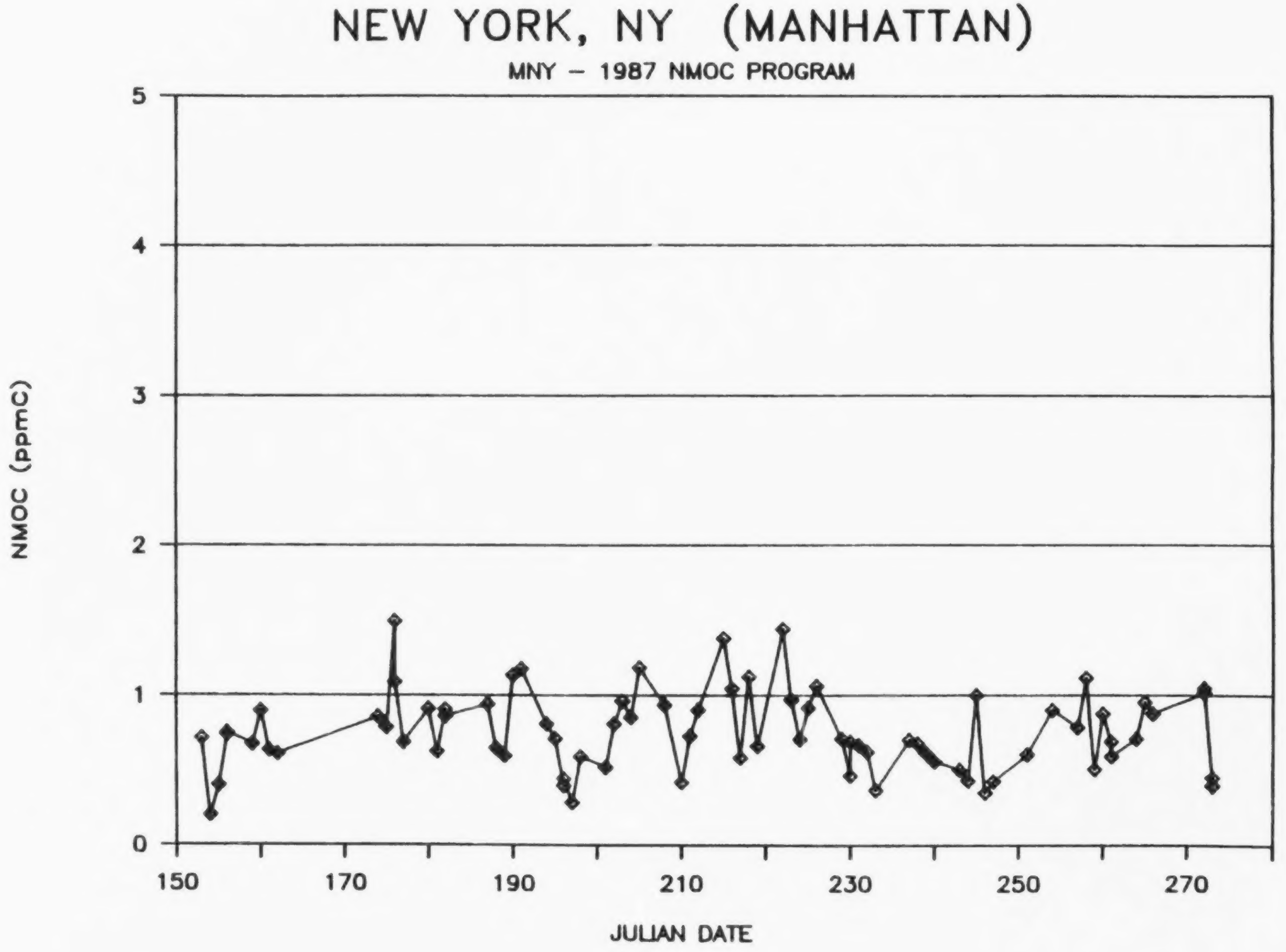

Figure 2-5. Plot of NMOC concentration for New York, NY (Manhattan).

TABLE 2-9. SUMMARY OF THE 1987 NMOC DATA FOR NEW YORK, NY (MNY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/02/87	153	T	1050	8	C	0.713		
06/03/87	154	W	1045	126	B	0.203		
06/04/87	155	H	1062	175	B	0.403		0.398
06/05/87	156	F	1092	301	D	0.740		
06/05/87	156	F	1093	48	D	0.750		
06/08/87	159	M	1149	89	C	0.675		
06/09/87	160	T	1189	680	C	0.896		
06/10/87	161	W	1186	645	C	0.636		
06/11/87	162	H	1222	153	B	0.610		
06/23/87	174	T	1459	198	D	0.856		
06/24/87	175	W	1504	55	C	0.786		
06/25/87	176	H	1518	42	D	1.494		
06/25/87	176	H	1519	180	D	1.091		
06/26/87	177	F	1570	118	C	0.689		
06/26/87	177	F	1570	118	D	0.689		
06/29/87	180	M	1603	304	D	0.909		
06/30/87	181	T	1594	96	A	0.626	0.711	0.612
07/01/87	182	W	1648	7	C	0.904		
07/01/87	182	W	1689	112	C	0.859		
07/06/87	187	M	1717	693	C	0.942	0.826	0.674
07/07/87	188	T	1744	18	C	0.650		
07/08/87	189	W	1798	307	B	0.599	0.619	0.516
07/09/87	190	H	1876	89	D	1.136		
07/10/87	191	F	1865	33	D	1.176		
07/13/87	194	M	1888	161	A	0.810	0.710	0.605
07/14/87	195	T	1951	121	C	0.711		
07/15/87	196	W	1949	188	B	0.396		
07/15/87	196	W	1950	703	B	0.444		
07/16/87	197	H	2001	42	C	0.284		
07/17/87	198	H	2039	308	A	0.590		
07/20/87	201	M	2053	49	D	0.521		
07/21/87	202	T	2098	166	D	0.810		
07/22/87	203	W	2131	662	D	0.960	0.783	0.742
07/23/87	204	H	2199	157	C	0.854		
07/24/87	205	F	2181	113	D	1.186		
07/27/87	208	M	2217	20	C	0.935	0.747	0.605
07/29/87	210	W	2286	163	A	0.420		
07/30/87	211	H	2331	721	D	0.727		
07/31/87	212	F	2348	668	C	0.901		0.669
08/03/87	215	M	2426	115	A	1.379		
08/04/87	216	T	2419	771	B	1.045		
08/05/87	217	W	2437	158	A	0.583		
08/06/87	218	H	2536	781	C	1.123		

TABLE 2-9. SUMMARY OF THE 1987 NMOC DATA FOR NEW YORK, NY (MNY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/07/87	219	F	2482	691	C	0.664		
08/10/87	222	M	2564	409	D	1.440		
08/11/87	223	T	2618	404	D	0.968		
08/12/87	224	W	2596	714	C	0.708		
08/13/87	225	H	2658	172	B	0.917	0.937	
08/14/87	226	F	2697	83	D	1.062		
08/17/87	229	M	2722	193	C	0.710		
08/18/87	230	T	2745	695	D	0.466		
08/18/87	230	T	2745	695	D	0.690		
08/19/87	231	W	2777	119	A	0.668	0.790	
08/20/87	232	H	2835	781	B	0.623		
08/21/87	233	F	2823	48	C	0.369		
08/25/87	237	T	2935	729	B	0.701		
09/26/87	238	W	2957	792	A	0.678		
08/27/87	239	H	2974	780	B	0.615		
08/28/87	240	F	3012	196	D	0.560		0.564
08/31/87	243	M	3041	186	B	0.502		
09/01/87	244	T	3095	705	A	0.432		
09/02/87	245	W	3128	624	C	0.999		
09/03/87	246	H	3171	766	D	0.352		
09/04/87	247	F	3198	702	B	0.428		
09/08/87	251	T	3417	771	B	0.607		
09/11/87	254	F	3409	702	B	0.903		0.937
09/14/87	257	M	3428	103	C	0.786		
09/15/87	258	T	3424	763	D	1.116		
09/16/87	259	W	3435	307	B	0.509		
09/17/87	260	H	3536	780	D	0.876		
09/18/87	261	F	3538	784	A	0.691		
09/18/87	261	F	3539	656	B	0.593		
09/21/87	264	M	3596	729	D	0.710		
09/22/87	265	T	3586	727	C	0.953		0.797
09/23/87	266	W	3584	166	C	0.876		
09/29/87	272	T	3743	185	B	1.016		
09/29/87	272	T	3744	767	A	1.047		
09/30/87	273	W	3766	151	A	0.453		
09/30/87	273	W	3767	180	B	0.400		

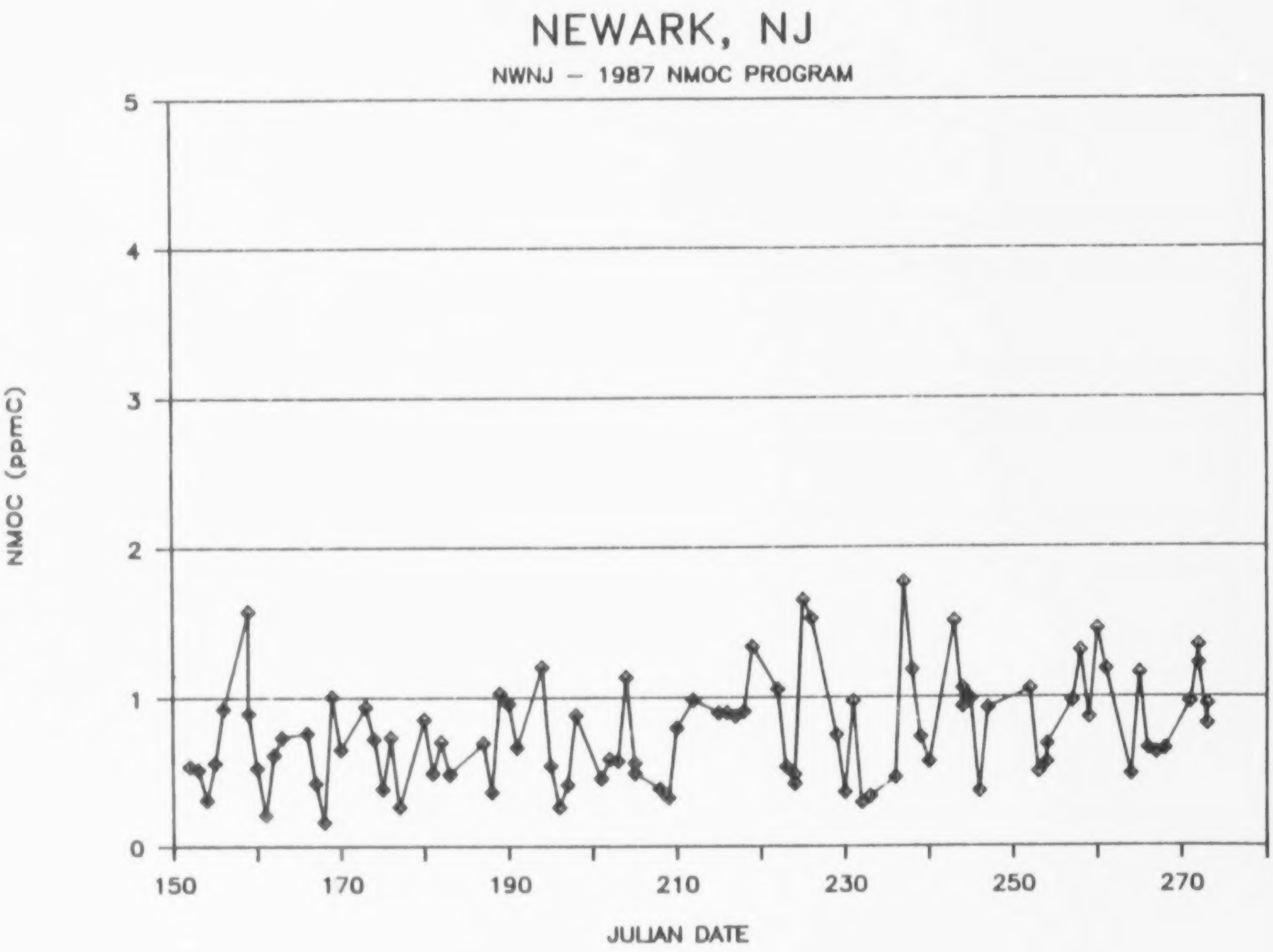

Figure 2-6. Plot of NMOC concentration for Newark, NJ.

TABLE 2-10. SUMMARY OF THE 1987 NMOC DATA FOR NEWARK, NJ (NWNJ)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1017	21	D	0.540		
06/02/87	153	T	1031	501	D	0.518		
06/03/87	154	W	1081	171	C	0.314	0.392	0.299
06/04/87	155	H	1091	193	B	0.562		
06/05/87	156	F	1126	139	C	0.926		
06/08/87	159	M	1133	673	A	1.577		
06/08/87	159	M	1134	670	A	0.896		
06/09/87	160	T	1169	121	D	0.529		
06/10/87	161	W	1194	170	B	0.214	0.276	0.186
06/11/87	162	H	1255	35	D	0.616		
06/12/87	163	F	1272	16	C	0.733		
06/15/87	166	M	1299	64	D	0.761		
06/16/87	167	T	1312	309	D	0.426		
06/17/87	168	W	1347	179	D	0.165		
06/18/87	169	H	1390	11	C	1.007		
06/19/87	170	F	1404	136	B	0.652		0.592
06/22/87	173	M	1451	19	D	0.938		
06/23/87	174	T	1467	409	B	0.722		
06/24/87	175	W	1500	22	D	0.387		
06/25/87	176	H	1527	17	A	0.734		
06/26/87	177	F	1579	75	B	0.268		
06/29/87	180	M	1634	79	D	0.854		
06/30/87	181	T	1627	12	D	0.491		
07/01/87	182	W	1677	140	A	0.702		
07/02/87	183	H	1724	97	B	0.484		
07/02/87	183	H	1725	25	B	0.485		
07/06/87	187	M	1753	726	B	0.693		
07/07/87	188	T	1796	51	D	0.364	0.392	0.385
07/08/87	189	W	1808	113	D	1.029		
07/09/87	190	H	1814	112	A	0.959		
07/10/87	191	F	1930	107	A	0.667		
07/13/87	194	M	1925	84	B	1.203		
07/14/87	195	T	1956	142	B	0.542		
07/15/87	196	W	2002	30	C	0.265		
07/16/87	197	H	2014	8	A	0.417		
07/17/87	198	F	2056	409	A	0.881		
07/20/87	201	M	2110	707	B	0.459		
07/21/87	202	T	2145	143	A	0.586		
07/22/87	203	W	2144	160	C	0.575		
07/23/87	204	H	2171	727	C	1.134		
07/24/87	205	F	2241	11	A	0.561		
07/24/87	205	F	2242	696	B	0.492		
07/27/87	208	M	2240	34	C	0.389		

TABLE 2-10. SUMMARY OF THE 1987 NMOC DATA FOR NEWARK, NJ (NWNJ)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/28/87	209	T	2517	31	C	0.33		
07/29/87	210	W	2274	112	D	0.796		
07/31/87	212	F	2414	84	C	0.984		
08/03/87	215	M	2415	646	C	0.895		
08/04/87	216	T	2467	34	B	0.900		
08/05/87	217	W	2491	136	C	0.874		
08/06/87	218	H	2489	780	D	0.906		
08/07/87	219	F	2748	146	D	1.336		
08/10/87	222	M	2614	764	A	1.054		
08/11/87	223	T	2612	713	A	0.533		
08/12/87	224	W	2648	646	B	0.421		
08/12/87	224	W	2680	661	C	0.483		
08/13/87	225	H	2674	135	C	1.650		
08/14/87	226	F	2739	798	C	1.524		
08/17/87	229	M	2717	630	D	0.747		
08/18/87	230	T	2776	14	A	0.364		
08/19/87	231	W	2809	54	D	0.972		
08/20/87	232	H	2812	73	D	0.296	0.385	
08/21/87	233	F	2895	133	B	0.336		
08/24/87	236	M	2912	645	B	0.464		
08/25/87	237	T	2927	724	C	1.764		1.123
08/26/87	238	W	3020	62	C	1.182		
08/27/87	239	H	2981	109	A	0.732		
08/28/87	240	F	3044	134	D	0.568		
08/31/87	243	M	3072	777	A	1.505	1.446	
09/01/87	244	T	3132	660	D	0.939		
09/01/87	244	T	3133	794	D	1.058		
09/02/87	245	W	3119	34	B	0.989		
09/03/87	246	H	3208	729	D	0.371		
09/04/87	247	F	3214	786	D	0.928		
09/08/87	252	W	3269	769	D	1.057		1.011
09/10/87	253	H	3315	151	B	0.500		
09/11/87	254	F	3339	657	C	0.564		
09/11/87	254	F	3339	657	A	0.686		
09/14/87	257	M	3389	705	C	0.974		
09/15/87	258	T	3436	790	B	1.309		
09/16/87	259	W	3465	55	B	0.864		
09/17/87	260	H	3523	306	C	1.451		
09/18/87	261	F	3532	693	D	1.184		
09/21/87	264	M	3570	725	A	0.484		
09/21/87	264	M	3571	79	C	0.484		
09/22/87	265	T	3578	175	D	1.159		
09/23/87	266	W	3641	182	A	0.656		0.663

TABLE 2-10. SUMMARY OF THE 1987 NMOC DATA FOR NEWARK, NJ (NWNJ)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/24/87	267	H	3656	307	A	0.626		
09/25/87	268	F	3708	793	C	0.652		
09/28/87	271	M	3717	789	D	0.967		
09/29/87	272	T	3752	196	D	1.344		
09/29/87	272	T	3752	196	A	1.223		
09/30/87	273	W	3780	115	A	0.820		
09/30/87	273	W	3781	706	B	0.953		0.855

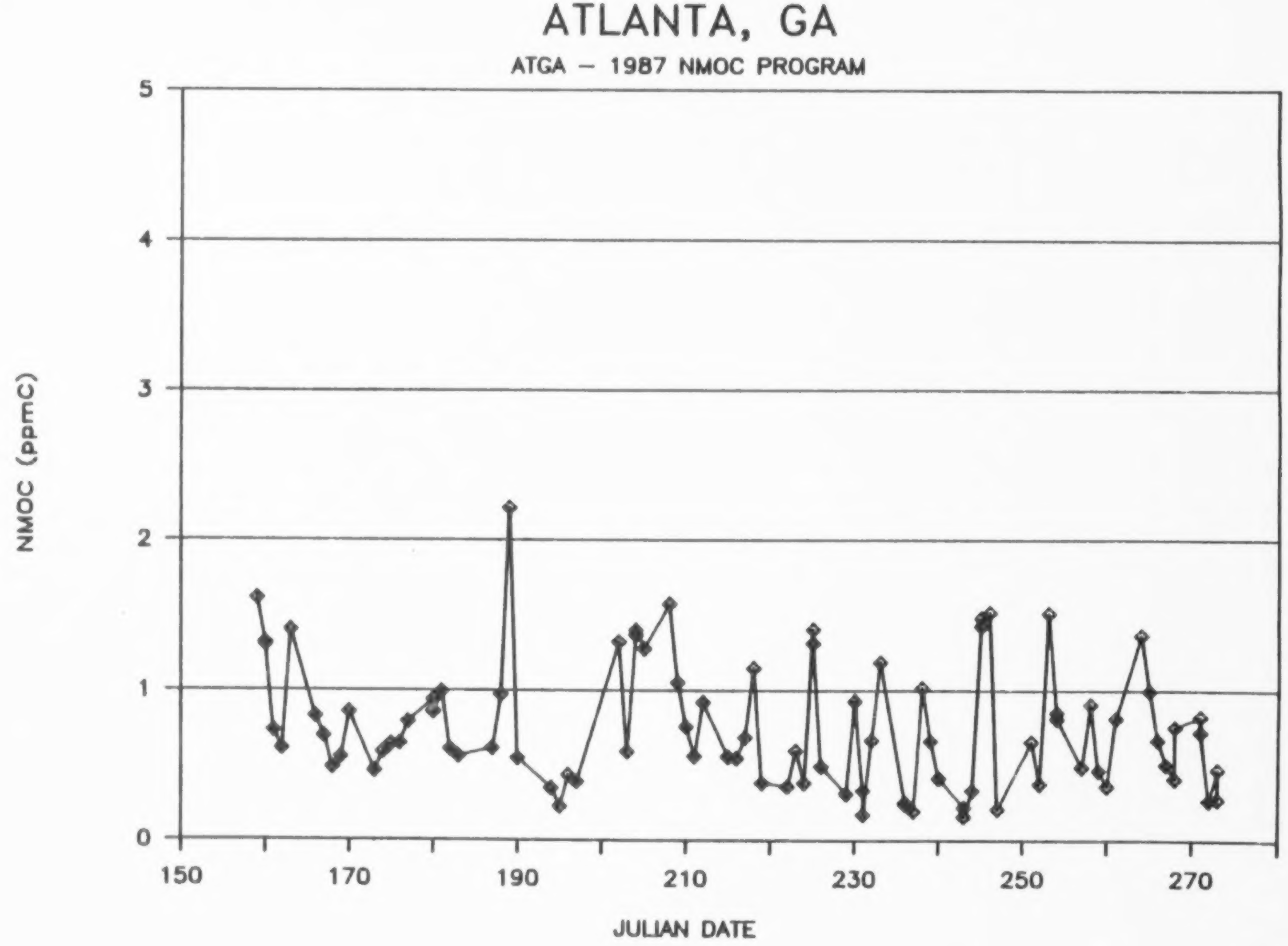

Figure 2-7. Plot of NMOC concentration for Atlanta, GA.

TABLE 2-11. SUMMARY OF THE 1987 NMOC DATA FOR ATLANTA, GA (ATGA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/08/87	159	M	1150	658	D	1.615		
06/09/87	160	T	1147	672	A	1.320		
06/09/87	160	T	1148	135	B	1.307		
06/10/87	161	W	1187	163	C	0.732		
06/11/87	162	H	1242	37	D	0.613		
06/12/87	163	F	1213	198	A	1.404	1.155	1.554
06/15/87	166	M	1259	501	D	0.829		
06/16/87	167	T	1324	55	C	0.698		
06/17/87	168	W	1358	52	C	0.486		
06/18/87	169	H	1356	38	D	0.555		
06/19/87	170	F	1396	647	B	0.857		
06/22/87	173	M	1403	689	C	0.463	0.533	0.430
06/23/87	174	T	1479	78	D	0.591		
06/24/87	175	W	1501	305	C	0.643		
06/25/87	176	H	1515	147	D	0.648		
06/26/87	177	F	1578	54	A	0.793		
06/29/87	180	M	1596	86	A	0.942		
06/29/87	180	M	1597	45	B	0.860		
06/30/87	181	T	1632	8	C	0.994		
07/01/87	182	W	1613	102	C	0.609	0.618	0.661
07/02/87	183	H	1701	17	A	0.563		
07/06/87	187	M	1752	101	B	0.614		
07/07/87	188	T	1790	717	A	0.972		
07/08/87	189	W	1817	720	B	2.213		
07/09/87	190	H	1844	403	A	0.547		
07/13/87	194	M	1929	686	B	0.349		0.331
07/14/87	195	T	1946	410	C	0.227		
07/15/87	196	W	1983	108	D	0.434		
07/16/87	197	H	2013	40	B	0.390		
07/21/87	202	T	2097	301	D	1.324		1.328
07/22/87	203	W	2140	673	B	0.594		
07/23/87	204	H	2125	703	A	1.367		
07/23/87	204	H	2126	647	A	1.402		
07/24/87	205	F	2176	46	D	1.278		
07/27/87	208	M	2284	95	B	1.575		
07/28/87	209	T	2282	669	C	1.054		
07/29/87	210	W	2299	151	A	0.758		
07/30/87	211	H	2349	106	C	0.563		0.288
07/31/87	212	F	2327	660	D	0.921		
08/03/87	215	M	2413	145	A	0.560		
08/04/87	216	T	2443	501	D	0.549		
08/05/87	217	W	2450	108	A	0.687		
08/06/87	218	H	2470	44	B	1.150	1.090	

TABLE 2-11. SUMMARY OF THE 1987 NMOC DATA FOR ATLANTA, GA (ATGA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/07/87	219	F	2508	137	D	0.385		
08/10/87	222	M	2576	133	B	0.359		
08/11/87	223	T	2601	118	A	0.599		
08/12/87	224	W	2628	105	C	0.384		
08/13/87	225	H	2672	66	B	1.407		
08/13/87	225	H	2683	698	D	1.315		
08/14/87	226	F	2647	796	C	0.494		
08/17/87	229	M	2706	638	D	0.313		
08/18/87	230	T	2763	92	C	0.930		
08/19/87	231	W	2786	703	C	0.335		
08/19/87	231	W	2786	703	A	0.174		
08/20/87	232	H	2855	709	A	0.669		
08/21/87	233	F	2871	35	D	1.187		
08/24/87	236	M	2873	659	A	0.256		
08/24/87	236	M	2873	659	D	0.244		
08/25/87	237	M	2940	667	C	0.198		
08/26/87	238	W	2943	802	C	1.016		
08/27/87	239	H	2987	176	D	0.663		
08/28/87	240	F	2976	16	C	0.417		
08/31/87	243	M	3039	150	C	0.223		
08/31/87	243	M	3039	150	A	0.159		
09/01/87	244	T	3094	105	B	0.335		
09/02/87	245	W	3136	651	A	1.430		
09/02/87	245	W	3137	6	A	1.482		
09/03/87	246	H	3152	305	B	1.520		
09/04/87	247	F	3181	24	B	0.210		
09/08/87	251	T	3232	784	A	0.656	0.755	
09/09/87	252	W	3264	161	A	0.380		0.358
09/10/87	253	H	3285	661	D	1.513		
09/11/87	254	F	3338	102	A	0.853		
09/11/87	254	F	3338	102	A	0.812		
09/14/87	257	M	3365	4	D	0.488		
09/15/87	258	T	3396	177	A	0.907		0.926
09/16/87	259	W	3416	163	A	0.467		
09/17/87	260	H	3462	672	C	0.363		
09/18/87	261	F	3456	106	B	0.816		0.385
09/21/87	264	M	3531	670	D	1.367		
09/22/87	265	T	3556	783	C	0.998		
09/23/87	266	W	3582	172	B	0.668		0.380
09/24/87	267	H	3634	24	A	0.507		
09/25/87	268	F	3637	799	B	0.413		
09/25/87	268	F	3638	83	D	0.756		
09/28/87	271	M	3706	700	D	0.825		

TABLE 2-11. SUMMARY OF THE 1987 NMOC DATA FOR ATLANTA, GA (ATGA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/28/87	271	M	3707	90	C	0.723		
09/29/87	272	T	3735	646	A	0.271		
09/29/87	272	T	3736	96	A	0.269		
09/30/87	273	W	3792	154	C	0.474		
09/30/87	273	W	3793	640	B	0.277		

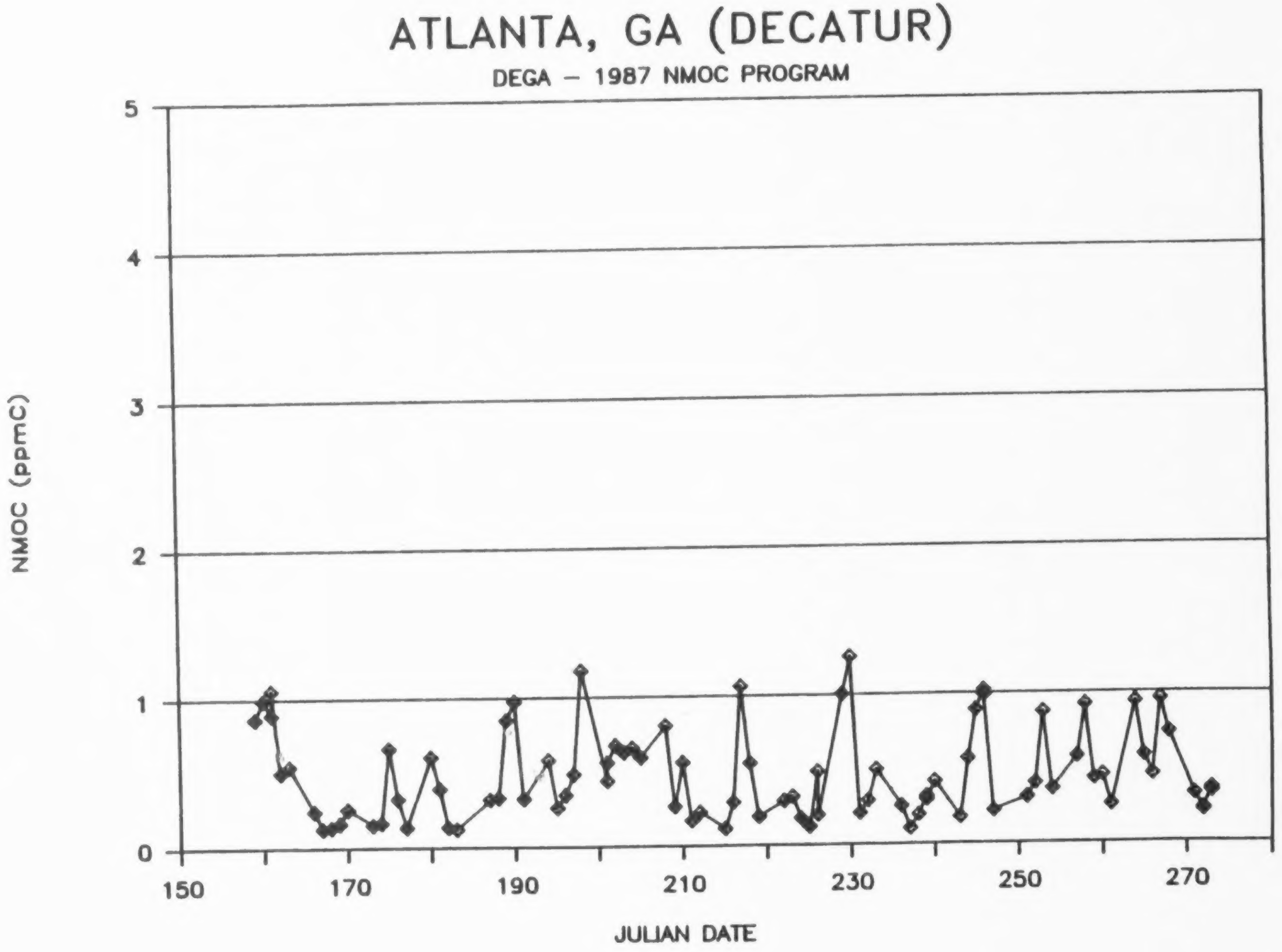

Figure 2-8. Plot of NMOC concentration for Atlanta, GA (Decatur).

TABLE 2-12. SUMMARY OF THE 1987 NMOC DATA FOR ATLANTA, GA (DEGA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/08/87	159	M	1152	662	D	0.867		
06/09/87	160	T	1226	651	C	0.991		
06/10/87	161	W	1176	675	A	0.893		
06/10/87	161	W	1177	669	C	1.060		
06/11/87	162	H	1241	196	C	0.505		
06/12/87	163	F	1212	97	D	0.549		
06/15/87	166	M	1260	62	C	0.246		
06/16/87	167	T	1323	40	D	0.128		
06/17/87	168	W	1357	118	D	0.138		
06/18/87	169	H	1355	662	B	0.165		
06/19/87	170	F	1375	115	B	0.262		
06/22/87	173	M	1408	684	C	0.154	0.218	0.126
06/23/87	174	T	1478	112	C	0.169		
06/24/87	175	W	1499	36	D	0.665		
06/25/87	176	H	1516	37	C	0.330		
06/26/87	177	F	1580	87	B	0.138		
06/29/87	180	M	1599	116	B	0.607		
06/30/87	181	T	1636	33	D	0.397		
07/01/87	182	W	1614	198	D	0.137		0.107
07/02/87	183	H	1698	32	C	0.125		
07/06/87	187	M	1756	43	B	0.322		
07/07/87	188	T	1791	718	A	0.334		
07/08/87	189	W	1816	145	D	0.850		
07/09/87	190	H	1843	672	A	0.975		
07/10/87	191	F	1859	20	C	0.326		
07/13/87	194	M	1928	32	D	0.581	0.547	0.501
07/14/87	195	T	1952	647	D	0.265		
07/15/87	196	W	1982	62	A	0.348		
07/16/87	197	H	2025	156	D	0.485		
07/17/87	198	F	2007	670	C	1.180		
07/20/87	201	M	2108	163	C	0.441		
07/20/87	201	M	2109	668	C	0.563		
07/21/87	202	T	2117	690	B	0.678		
07/22/87	203	W	2135	4	B	0.628		
07/23/87	204	H	2147	725	C	0.661		
07/24/87	205	F	2177	89	C	0.596		
07/27/87	208	M	2276	131	D	0.806		
07/28/87	209	T	2277	139	D	0.267		
07/29/87	210	W	2306	305	C	0.558		
07/30/87	211	H	2332	401	A	0.170		0.133
07/31/87	212	F	2339	185	C	0.228		
08/03/87	215	M	2417	722	A	0.116		
08/04/87	216	T	2442	104	C	0.292		

TABLE 2-12. SUMMARY OF THE 1987 NMOC DATA FOR ATLANTA, GA (DEGA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/05/87	217	W	2452	767	D	1.066		
08/06/87	218	H	2469	164	A	0.551	0.577	
08/07/87	219	F	2490	680	D	0.195		
08/10/87	222	M	2571	621	D	0.297		
08/11/87	223	T	2592	161	C	0.327		
08/12/87	224	W	2638	707	C	0.180		
08/13/87	225	H	2644	11	B	0.125		
08/14/87	226	F	2676	794	C	0.491	0.406	
08/14/87	226	F	2677	797	C	0.202		
08/17/87	229	M	2707	783	C	1.005		
08/18/87	230	T	2762	785	C	1.257		
08/19/87	231	W	2788	192	D	0.210		
08/20/87	232	H	2854	670	D	0.296		
08/21/87	233	F	2853	652	D	0.500		
08/24/87	236	M	2902	188	B	0.255		
08/25/87	237	M	2941	120	D	0.103		
08/26/87	238	W	2936	182	A	0.197		
08/27/87	239	H	2975	629	D	0.320		
08/27/87	239	H	2975	629	C	0.299		
08/28/87	240	F	3017	64	B	0.418		
08/31/87	243	M	3045	763	D	0.176		
09/01/87	244	T	3092	57	D	0.567		
09/02/87	245	W	3102	721	D	0.891	0.946	
09/03/87	246	H	3193	309	B	1.022		
09/03/87	246	H	3155	647	A	0.989		
09/04/87	247	F	3165	126	B	0.218		0.164
09/08/87	251	T	3230	405	A	0.310		
09/09/87	252	W	3267	678	D	0.402		
09/10/87	253	H	3287	138	C	0.872		
09/11/87	254	F	3336	51	D	0.363		
09/14/87	257	M	3363	635	B	0.577		
09/15/87	258	T	3399	150	D	0.922		0.858
09/16/87	259	W	3413	153	A	0.431		
09/17/87	260	H	3476	49	D	0.451		
09/18/87	261	F	3461	796	C	0.257		
09/21/87	264	M	3525	644	B	0.939		0.921
09/22/87	265	T	3560	305	D	0.581		
09/23/87	266	W	3590	631	B	0.454		0.438
09/24/87	267	H	3639	52	C	0.955		0.840
09/25/87	268	F	3620	22	C	0.732		
09/28/87	271	M	3698	35	A	0.323		
09/29/87	272	T	3737	155	B	0.213		
09/29/87	272	T	3738	709	A	0.226		

TABLE 2-12. SUMMARY OF THE 1987 NMOC DATA FOR ATLANTA, GA (DEGA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/30/87	273	W	3790	658	A	0.360		
09/30/87	273	W	3791	39	C	0.338		

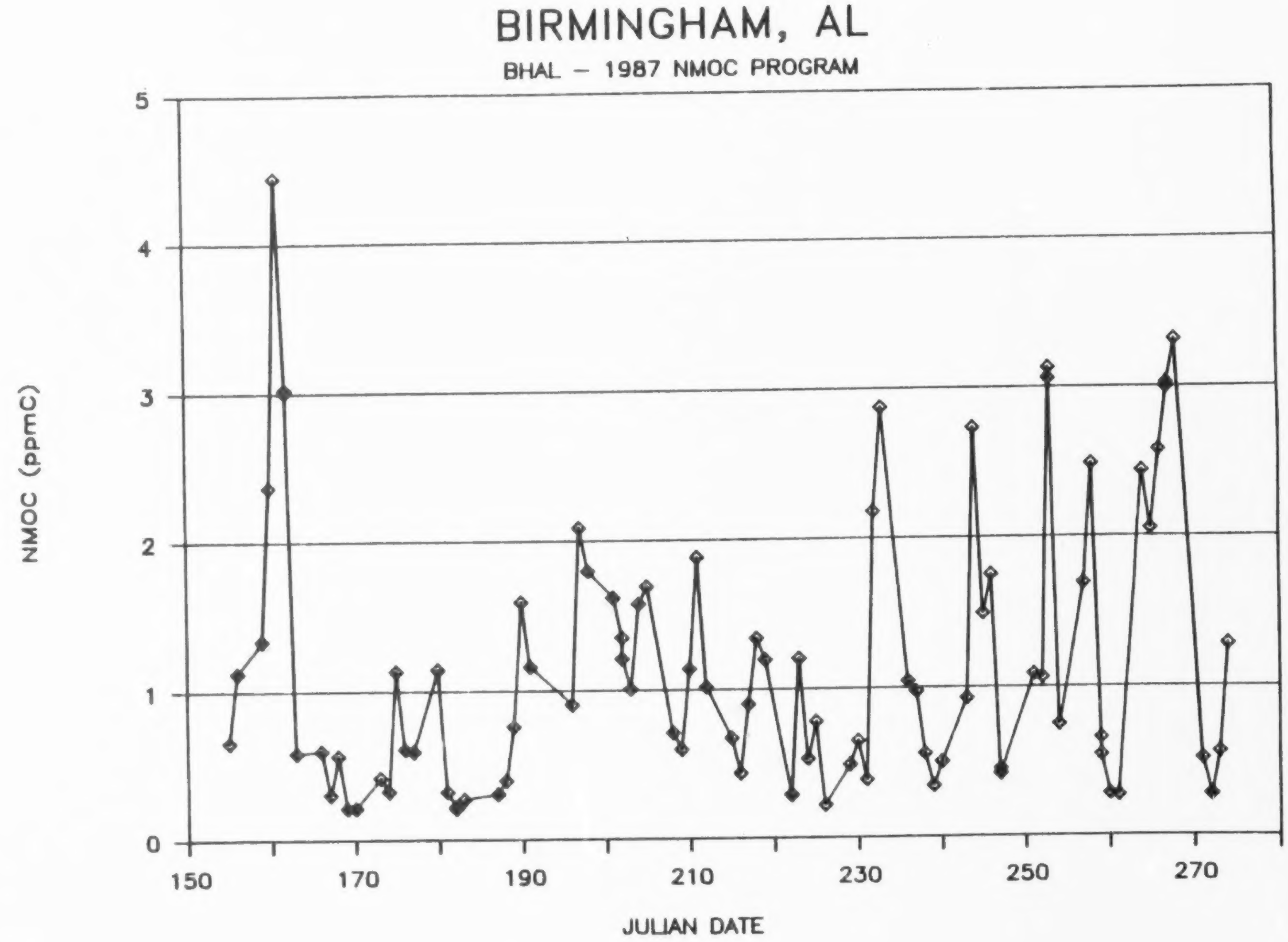

Figure 2-9. Plot of NMOC concentration for Birmingham, AL.

TABLE 2-13. SUMMARY OF THE 1987 NMOC DATA FOR BIRMINGHAM, AL (BHAL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/04/87	155	H	1116	661	A	0.658		
06/05/87	156	F	1123	655	A	1.125		
06/08/87	159	M	1105	654	C	1.340		
06/09/87	160	T	1191	126	C	2.367		
06/10/87	161	W	1205	109	C	4.448		5.199
06/11/87	162	H	1236	190	C	3.029		
06/11/87	162	H	1228	86	C	3.008		
06/12/87	163	F	1267	12	C	0.583		
06/15/87	166	M	1292	30	D	0.598		
06/16/87	167	T	1369	66	B	0.305		
06/17/87	168	W	1345	649	C	0.564		
06/18/87	169	H	1372	175	A	0.216		
06/19/87	170	F	1420	45	D	0.215		
06/22/87	173	M	1441	688	A	0.418		
06/23/87	174	T	1455	135	C	0.329		0.336
06/24/87	175	W	1474	51	C	1.134		
06/25/87	176	H	1530	719	D	0.613		
06/26/87	177	F	1539	31	A	0.595		
06/29/87	180	M	1644	158	D	1.145		
06/30/87	181	T	1615	170	D	0.325		
07/01/87	182	W	1666	164	B	0.225		
07/01/87	182	W	1672	181	A	0.214		
07/02/87	183	H	1686	672	B	0.276		
07/06/87	187	M	1767	139	B	0.310		
07/07/87	188	T	1834	90	B	0.399		
07/08/87	189	W	1831	719	C	0.760		
07/09/87	190	H	1830	722	A	1.593		
07/10/87	191	F	1872	146	D	1.162		
07/15/87	196	W	1975	687	C	0.907		
07/16/87	197	H	2000	684	D	2.087		
07/17/87	198	F	2064	97	D	1.797		1.632
07/20/87	201	M	2074	60	C	1.617		
07/21/87	202	T	2093	708	C	1.352		
07/21/87	202	T	2094	674	D	1.210		
07/22/87	203	W	2133	175	C	1.008		1.085
07/23/87	204	H	2187	25	C	1.576		
07/24/87	205	F	2238	15	D	1.690		
07/27/87	208	M	2256	114	C	0.713		
07/28/87	209	T	2275	41	C	0.601		
07/29/87	210	W	2312	650	C	1.141		
07/30/87	211	H	2292	500	C	1.884		1.789
07/31/87	212	F	2337	728	A	1.021		
08/03/87	215	M	2410	38	A	0.675		

TABLE 2-13. SUMMARY OF THE 1987 NMOC DATA FOR BIRMINGHAM, AL (BHAL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/04/87	216	T	2475	140	D	0.439		
08/05/87	217	W	2527	695	D	0.903		
08/06/87	218	H	2521	152	C	1.339		
08/07/87	219	F	2484	784	B	1.198		
08/10/87	222	M	2599	712	A	0.295		
08/10/87	222	M	2610	35	D	0.289		
08/11/87	223	T	2624	675	C	1.201		
08/12/87	224	W	2634	660	D	0.531		
08/13/87	225	H	2645	778	D	0.781		
08/14/87	226	F	2650	78	C	0.223		
08/17/87	229	M	2733	98	C	0.488		
08/18/87	230	T	2766	410	C	0.650		
08/19/87	231	W	2805	140	D	0.387		
08/20/87	232	H	2824	51	C	2.177		
08/21/87	233	F	2882	122	C	2.873		
08/24/87	236	M	2901	10	C	1.046		
08/25/87	237	T	2955	99	D	0.974		
08/26/87	238	W	2996	728	B	0.558		
08/27/87	239	H	2977	83	D	0.343		
08/28/87	240	F	3064	175	D	0.503		
08/31/87	243	M	3082	152	C	0.930		
09/01/87	244	T	3157	785	D	2.734		
09/02/87	245	W	3148	145	D	1.491		
09/03/87	246	H	3186	140	D	1.751		
09/04/87	247	F	3220	639	A	0.456		
09/04/87	247	F	3237	45	C	0.422		
09/08/87	251	T	3244	115	C	1.087		
09/09/87	252	W	3299	18	C	1.065		
09/10/87	253	H	3323	629	B	3.060		
09/10/87	253	H	3324	776	A	3.130		
09/11/87	254	F	3390	80	C	0.750		
09/14/87	257	M	3382	682	D	1.692		1.624
09/15/87	258	T	3407	116	D	2.486		
09/16/87	259	W	3439	792	D	0.658		
09/16/87	259	W	3440	164	D	0.542		
09/17/87	260	H	3471	636	C	0.285		
09/18/87	261	F	3514	403	B	0.275		
09/21/87	264	M	3549	623	A	2.439		
09/22/87	265	T	3591	808	A	2.052		
09/23/87	266	W	3617	148	B	2.578		
09/24/87	267	H	3612	38	B	2.997		
09/24/87	267	H	3613	164	C	3.024		
09/25/87	268	F	3629	106	C	3.314		2.894

TABLE 2-13. SUMMARY OF THE 1987 NMOC DATA FOR BIRMINGHAM, AL (BHAL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/28/87	271	M	3729	189	C	0.516		0.549
09/29/87	272	T	3772	25	D	0.280		
09/29/87	272	T	3773	118	D	0.274		
09/30/87	273	W	3798	661	D	0.562		
10/01/87	274	H	3800	175	C	1.280		

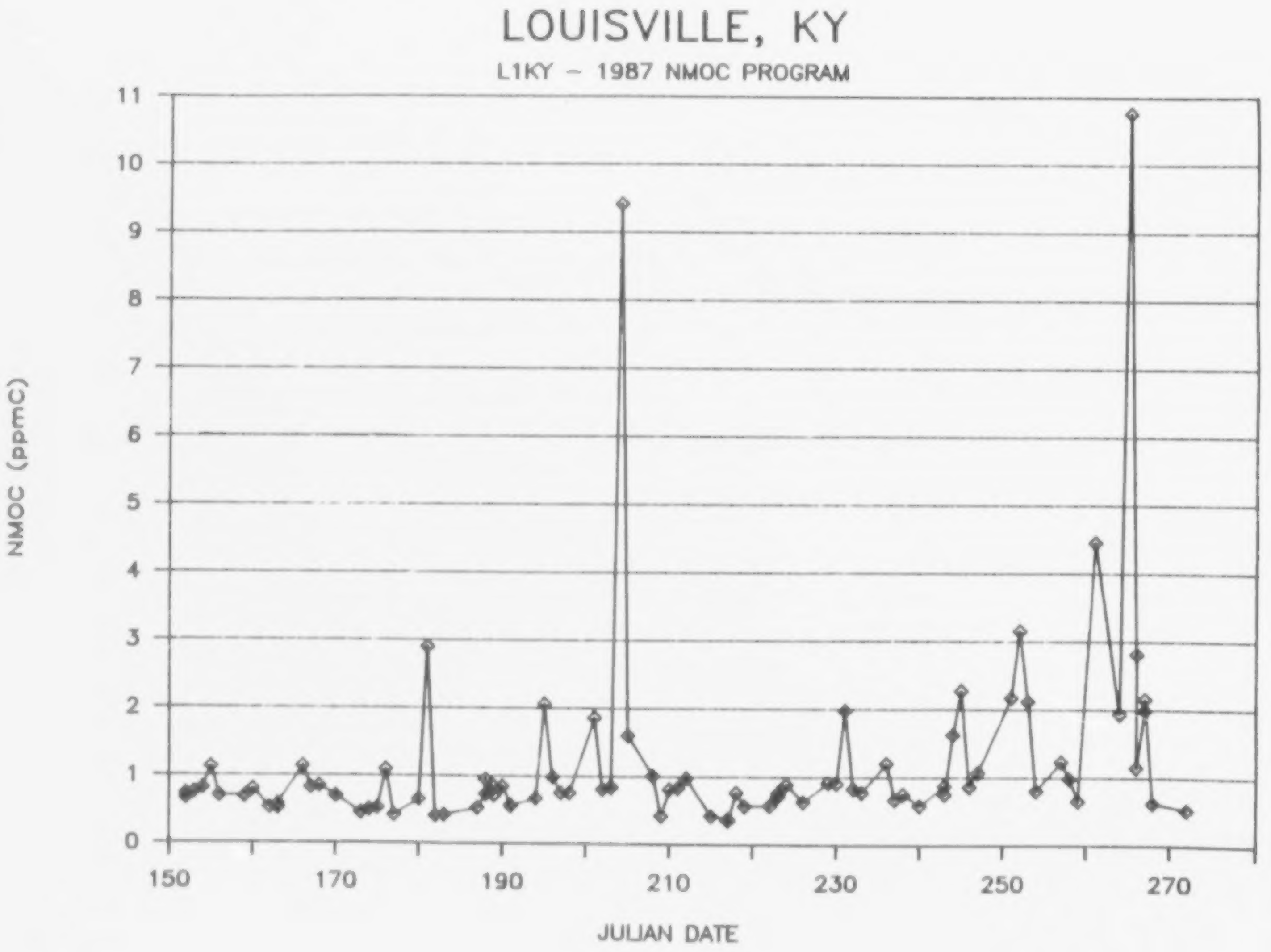

Figure 2-10. Plot of NMOC concentration for Louisville, KY (Expanded).

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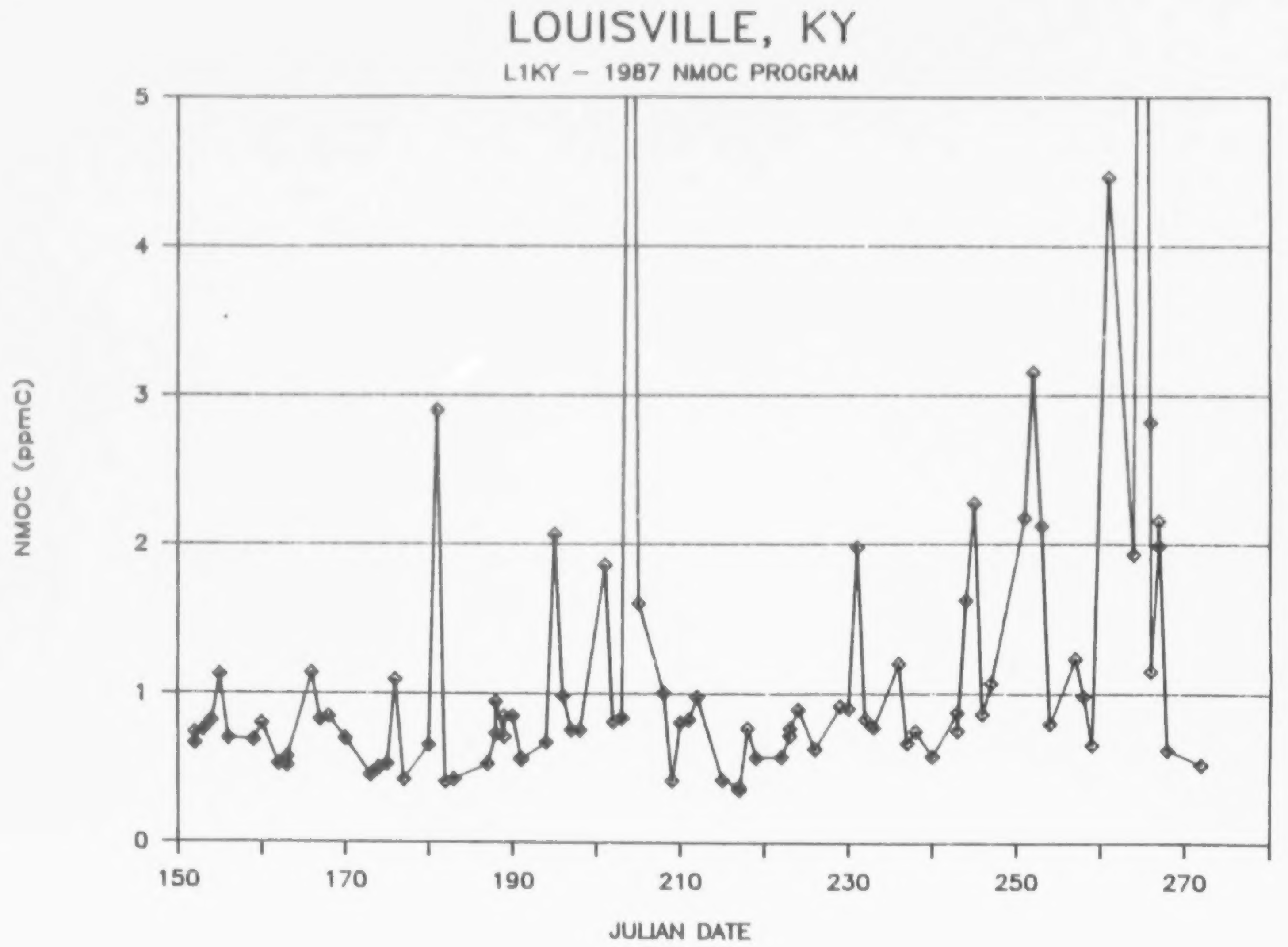

Figure 2-11. Plot of NMOC concentration for Louisville, KY.

TABLE 2-14. SUMMARY OF THE 1987 NMOC DATA FOR LOUISVILLE, KY (L1KY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1001	108	C	0.664		
06/01/87	152	M	1001	108	A	0.737		
06/02/87	153	T	1049	118	D	0.754		
06/03/87	154	W	1072	82	A	0.818		
06/04/87	155	H	1083	112	C	1.126	0.984	1.034
06/05/87	156	F	1111	410	B	0.700	0.755	0.748
06/08/87	159	M	1131	183	D	0.686	0.707	0.660
06/09/87	160	T	1180	660	A	0.797		
06/11/87	162	H	1225	172	D	0.525		
06/12/87	163	F	1268	193	B	0.514		
06/12/87	163	F	1275	61	B	0.574		
06/15/87	166	M	1297	679	B	1.137		
06/16/87	167	T	1330	57	A	0.825		
06/17/87	168	W	1344	152	C	0.846		
06/19/87	170	F	1376	20	A	0.697	0.681	0.667
06/22/87	173	M	1447	644	A	0.451		
06/23/87	174	T	1464	687	A	0.501		
06/23/87	174	T	1464	687	A	0.501		
06/24/87	175	W	1503	64	B	0.524		
06/25/87	176	H	1563	718	A	1.093		
06/26/87	177	F	1521	120	C	0.421	0.410	0.500
06/29/87	180	M	1605	175	C	0.654		
06/30/87	181	T	1635	91	C	2.896		
07/01/87	182	W	1659	111	B	0.408		
07/02/87	183	H	1704	302	A	0.423		
07/06/87	187	M	1715	62	C	0.527		
07/07/87	188	T	1782	152	B	0.730		
07/07/87	188	T	1783	677	D	0.948		
07/08/87	189	W	1794	46	A	0.712		
07/08/87	189	W	1794	46	C	0.847		
07/09/87	190	H	1881	95	C	0.848		
07/10/87	191	F	1838	141	D	0.568		
07/10/87	191	F	1838	141	A	0.555		
07/13/87	194	M	1919	78	C	0.675		
07/14/87	195	T	1942	74	D	2.064		
07/15/87	196	W	1969	678	C	0.986		
07/16/87	197	H	2017	130	B	0.755		
07/17/87	198	F	2004	75	D	0.755		
07/20/87	201	M	2083	187	D	1.859	1.630	1.719
07/21/87	202	T	2100	181	D	0.811		
07/22/87	203	W	2103	84	D	0.844		
07/22/87	203	W	2104	403	D	0.835		
07/23/87	204	H	2196	121	C	9.420		9.553

TABLE 2-14. SUMMARY OF THE 1987 NMOC DATA FOR LOUISVILLE, KY (L1KY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/24/87	205	F	2198	153	D	1.603		
07/27/87	208	M	2247	56	C	1.007		
07/28/87	209	T	2261	137	A	0.418	0.415	0.362
07/29/87	210	W	2308	632	D	0.807		
07/30/87	211	H	2323	659	A	0.827		
07/31/87	212	F	2319	16	A	0.978		
08/03/87	215	M	2402	126	A	0.420		
08/05/87	217	W	2454	139	B	0.377		
08/05/87	217	W	2454	139	C	0.354		
08/06/87	218	H	2479	688	C	0.768		
08/07/87	219	F	2492	55	C	0.569		
08/10/87	222	M	2561	73	D	0.577		
08/11/87	223	T	2620	309	B	0.715		
08/11/87	223	T	2621	678	D	0.766		
08/12/87	224	W	2637	771	D	0.892		
08/14/87	226	F	2667	696	A	0.630		
08/17/87	229	M	2743	763	C	0.916		
08/18/87	230	T	2771	780	B	0.903		
08/19/87	231	W	2783	781	D	1.977		
08/20/87	232	H	2838	409	B	0.830		
08/21/87	233	F	2825	39	B	0.773		
08/24/87	236	M	2890	115	C	1.200		
08/25/87	237	T	2938	60	D	0.668		
08/26/87	238	W	2958	11	A	0.746		
08/28/87	240	F	3021	90	C	0.578		
08/31/87	243	M	3066	160	C	0.874		
08/31/87	243	M	3067	157	D	0.750		
09/01/87	244	T	3088	622	A	1.625		
09/02/87	245	W	3110	668	D	2.272		2.177
09/03/87	246	H	3169	52	C	0.862		
09/04/87	247	F	3151	770	C	1.071		
09/08/87	251	T	3204	74	C	2.173		
09/09/87	252	W	3249	633	C	3.155		3.150
09/10/87	253	H	3282	696	D	2.122		
09/11/87	254	F	3306	137	C	0.800		
09/14/87	257	M	3366	22	D	1.232		
09/15/87	258	T	3368	621	D	0.982		
09/16/87	259	W	3426	764	B	0.658		
09/18/87	261	F	3472	649	C	4.462		
09/21/87	264	M	3530	703	C	1.933		
09/22/87	265	T	3548	1	D	10.767		
09/23/87	266	W	3583	766	C	2.821		
09/23/87	266	W	3677	75	C	1.151		0.943

TABLE 2-14. SUMMARY OF THE 1987 NMOC DATA FOR LOUISVILLE, KY (L1KY)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/24/87	267	H	3670	698	B	1.990		
09/24/87	267	H	3671	103	C	2.154		
09/25/87	268	F	3659	16	D	0.625		
09/29/87	272	T	3720	171	A	0.526		

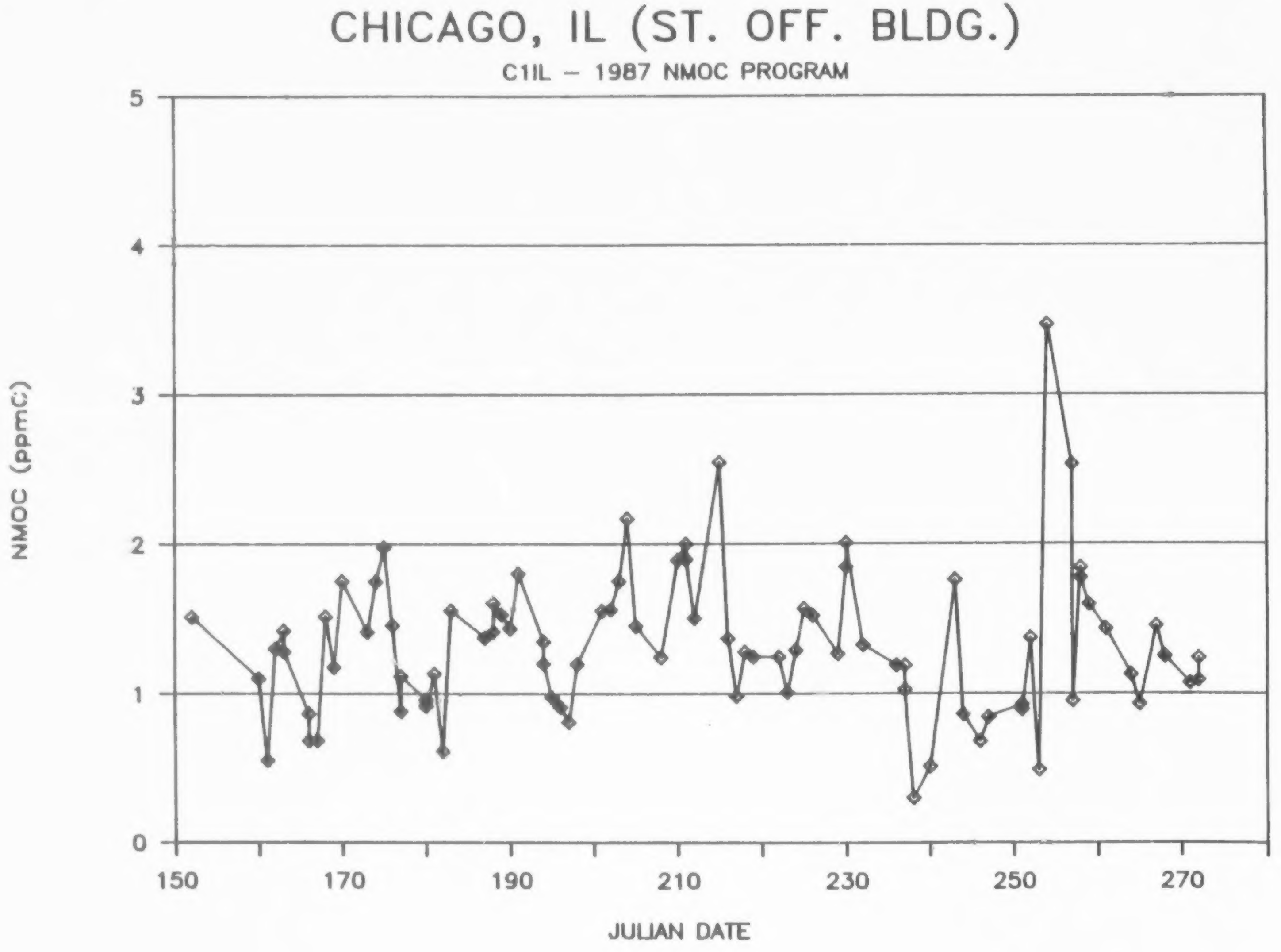

Figure 2-12. Plot of NMOC concentration for Chicago, IL (State Office Building).

TABLE 2-15. SUMMARY OF THE 1987 NMOC DATA FOR CHICAGO, IL (C1IL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1018	191	C	1.514		
06/09/87	160	T	1159	649	A	1.102		
06/10/87	161	W	1252	188	A	0.551		
06/11/87	162	H	1240	197	D	1.303		
06/12/87	163	F	1258	133	C	1.423		
06/12/87	163	F	1258	133	B	1.285		
06/15/87	166	M	1284	650	A	0.864		
06/15/87	166	M	1285	51	B	0.682		
06/16/87	167	T	1302	183	C	0.686		0.801
06/17/87	168	W	1365	307	C	1.517		
06/18/87	169	H	1418	114	A	1.180		
06/19/87	170	F	1411	302	C	1.752		
06/22/87	173	M	1457	172	C	1.416		
06/23/87	174	T	1469	693	D	1.749	1.806	1.932
06/24/87	175	W	1506	143	A	1.977		
06/25/87	176	H	1528	152	A	1.458		
06/26/87	177	F	1513	726	A	0.883		
06/26/87	177	F	1513	726	D	1.119		
06/29/87	180	M	1588	113	D	0.959		
06/29/87	180	M	1588	113	A	0.919		
06/30/87	181	T	1651	196	C	1.135		
07/01/87	182	W	1618	92	B	0.613		
07/02/87	183	H	1683	10	D	1.557		1.429
07/06/87	187	M	1713	153	D	1.377	1.115	1.097
07/07/87	188	T	1784	176	B	1.418		
07/07/87	188	T	1785	160	D	1.608		
07/08/87	189	W	1789	674	D	1.530		
07/09/87	190	H	1866	91	C	1.437		
07/10/87	191	F	1874	187	C	1.803		
07/13/87	194	M	1900	106	B	1.352		
07/13/87	194	M	1900	106	B	1.201		
07/14/87	195	T	1937	21	C	0.974	0.836	0.784
07/15/87	196	W	1980	100	C	0.910		
07/16/87	197	H	2030	500	C	0.808		
07/17/87	198	F	2020	682	C	1.200		
07/20/87	201	M	2055	192	D	1.555		
07/21/87	202	T	2115	96	A	1.565		
07/22/87	203	W	2137	47	B	1.754	1.634	1.796
07/23/87	204	H	2179	78	C	2.169		
07/24/87	205	F	2208	180	A	1.455		
07/27/87	208	M	2234	654	C	1.244		
07/29/87	210	W	2301	667	D	1.893		
07/30/87	211	H	2340	181	C	2.001		

TABLE 2-15. SUMMARY OF THE 1987 NMOC DATA FOR CHICAGO, IL (C1IL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/30/87	211	H	2344	307	B	1.898		
07/31/87	212	F	2343	699	B	1.506	1.387	1.449
08/03/87	215	M	2421	142	C	2.546		
08/04/87	216	T	2444	186	B	1.372		
08/05/87	217	W	2473	15	B	0.983		
08/06/87	218	H	2498	131	D	1.280		
08/07/87	219	F	2535	4	A	1.248		
08/10/87	222	M	2570	175	C	1.246		
08/11/87	223	T	2585	21	A	1.009		
08/12/87	224	W	2630	60	A	1.291		
08/13/87	225	H	2702	80	B	1.571		
08/14/87	226	F	2747	782	A	1.525		
08/17/87	229	M	2723	8	D	1.270		
08/18/87	230	T	2760	20	B	1.847		
08/18/87	230	T	2760	20	D	2.009		
08/20/87	232	H	2822	690	A	1.330		
08/24/87	236	M	2898	101	B	1.190		
08/25/87	237	T	2909	634	C	1.190		
08/25/87	237	T	2910	72	D	1.029		
08/26/87	238	W	2963	725	D	0.301		
08/28/87	240	F	2978	147	C	0.510	0.520	
08/31/87	243	M	3084	646	A	1.760		
09/01/87	244	T	3087	36	B	0.862		
09/03/87	246	H	3175	670	A	0.679		
09/04/87	247	F	3206	47	B	0.843		0.819
09/08/87	251	T	3215	404	B	0.929		
09/08/87	251	T	3215	404	B	0.892		
09/09/87	252	W	3271	649	D	1.377		
09/10/87	253	H	3294	671	A	0.489		
09/11/87	254	F	3321	809	B	3.470		
09/14/87	257	M	3330	95	B	2.533		2.689
09/14/87	257	M	3331	659	A	0.951		0.936
09/15/87	258	T	3346	38	C	1.842		1.738
09/15/87	258	T	3347	34	D	1.774		1.633
09/16/87	259	W	3429	654	A	1.599		
09/18/87	261	F	3524	661	C	1.434		
09/21/87	264	M	3552	157	B	1.130		
09/22/87	265	T	3551	190	B	0.931		
09/24/87	267	H	3636	149	B	1.456		
09/25/87	268	F	3669	655	D	1.256		
09/25/87	268	F	3668	45	B	1.254		
09/28/87	271	M	3686	788	A	1.072		
09/29/87	272	T	3727	703	C	1.093		

TABLE 2-15. SUMMARY OF THE 1987 NMOC DATA FOR CHICAGO, IL (C1IL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/29/87	272	T	3764	158	D	1.241		0.987

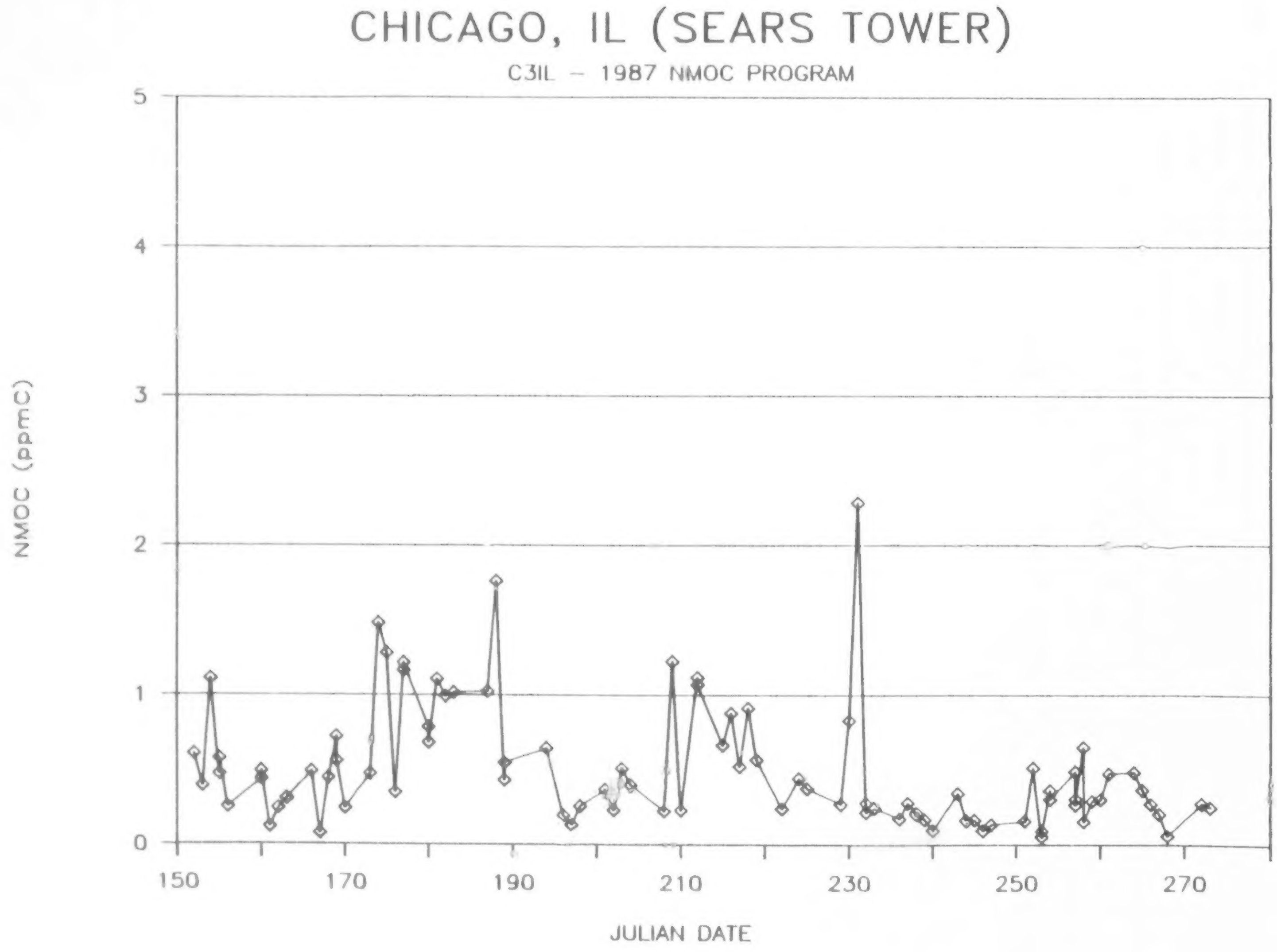

Figure 2-13. Plot of NMOC concentration for Chicago, IL (Sears Tower).

TABLE 2-16. SUMMARY OF THE 1987 NMOC DATA FOR CHICAGO, IL (C3IL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1019	160	D	0.603		
06/02/87	153	T	1013	172	B	0.390	0.421	0.409
06/03/87	154	W	1069	37	D	1.109		
06/04/87	155	H	1075	61	D	0.468		
06/04/87	155	H	1075	61	C	0.573		
06/05/87	156	F	1110	78	B	0.249		
06/09/87	160	T	1161	656	D	0.435		
06/09/87	160	T	1161	656	C	0.488		
06/10/87	161	W	1253	158	B	0.118		
06/11/87	162	H	1243	19	D	0.242		
06/12/87	163	F	1257	140	A	0.310		
06/12/87	163	F	1257	140	B	0.303		
06/15/87	166	M	1307	654	C	0.486		
06/16/87	167	T	1325	147	A	0.075		
06/16/87	167	T	1326	129	C	0.077		
06/17/87	168	W	1367	177	C	0.445		
06/18/87	169	H	1402	89	D	0.718		
06/18/87	169	H	1402	89	B	0.556		
06/19/87	170	F	1412	196	D	0.241		
06/22/87	173	M	1446	157	B	0.471		
06/23/87	174	T	1468	178	B	1.480		1.476
06/24/87	175	W	1508	673	A	1.282		
06/25/87	176	H	1529	56	C	0.349		
06/26/87	177	F	1514	660	C	1.167		
06/26/87	177	F	1514	660	D	1.216		
06/29/87	180	M	1587	93	B	0.784		
06/29/87	180	M	1587	93	A	0.680		
06/30/87	181	T	1652	664	D	1.107		
07/01/87	182	W	1619	190	B	0.992		
07/02/87	183	H	1684	57	A	1.016	1.048	1.124
07/06/87	187	M	1712	697	B	1.024	0.970	0.887
07/07/87	188	T	1781	171	D	1.760		
07/08/87	189	W	1828	83	C	0.430		
07/08/87	189	W	1829	649	C	0.544		
07/13/87	194	M	1901	186	D	0.642		
07/15/87	196	W	1976	692	B	0.194		
07/16/87	197	H	2037	36	D	0.130		
07/17/87	198	F	2023	646	C	0.257		
07/20/87	201	M	2057	146	D	0.369		
07/21/87	202	T	2118	679	A	0.230		
07/22/87	203	W	2136	18	C	0.509	0.398	0.341
07/23/87	204	H	2172	186	B	0.398		
07/27/87	208	M	2232	7	C	0.225		

TABLE 2-16. SUMMARY OF THE 1987 NMOC DATA FOR CHICAGO, IL (C3IL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/28/87	209	T	2280	10	C	1.224		
07/29/87	210	W	2310	12	C	0.231		
07/31/87	212	F	2364	190	C	1.117	0.951	0.835
07/31/87	212	F	2365	22	C	1.071		
08/03/87	215	M	2420	72[illegible]	C	0.663		
08/04/87	216	T	2429	874	C	0.878		
08/05/87	217	W	2461	697	D	0.520		
08/06/87	218	H	2526	721	A	0.913		
08/07/87	219	F	2532	33	D	0.566		
08/10/87	222	M	2573	668	B	0.238		
08/12/87	224	W	2633	700	A	0.442		
08/13/87	225	H	2703	28	A	0.373	0.455	
08/17/87	229	M	2724	147	A	0.270		
08/18/87	230	T	2759	169	C	0.829		
08/19/87	231	W	2819	55	A	2.280		
08/20/87	232	H	2866	765	B	0.279		
08/20/87	232	H	2865	22	A	0.215		
08/21/87	233	F	2834	52	B	0.243		
08/24/87	236	M	2896	675	B	0.175		
08/25/87	237	T	2947	706	C	0.279		
08/26/87	238	W	2968	38	C	0.209		
08/27/87	239	H	3015	673	C	0.169		
08/28/87	240	F	2997	681	A	0.095		
08/31/87	243	M	3079	716	C	0.342		
09/01/87	244	T	3085	180	C	0.162		
09/02/87	245	W	3122	50	B	0.165		
09/03/87	246	H	3176	793	D	0.093	0.223	
09/04/87	247	F	3209	77	D	0.134		
09/08/87	251	T	3218	25	C	0.159		
09/09/87	252	W	3265	177	C	0.511		
09/10/87	253	H	3273	134	B	0.053		
09/10/87	253	H	3274	711	C	0.094		0.096
09/11/87	254	F	3311	57	A	0.362		
09/11/87	254	F	3311	57	A	0.304		
09/14/87	257	M	3328	142	C	0.488		0.519
09/14/87	257	M	3329	40	C	0.487		0.473
09/14/87	257	M	3332	721	C	0.267		0.214
09/14/87	257	M	3333	12	D	0.307		0.203
09/15/87	258	T	3345	[illegible]67	D	0.648		0.515
09/15/87	258	T	3348	501	C	0.155		0.149
09/16/87	259	W	3427	663	C	0.293		
09/17/87	260	H	3484	16	D	0.304		
09/18/87	261	F	3519	728	A	0.476		

TABLE 2-16. SUMMARY OF THE 1987 NMOC DATA FOR CHICAGO, IL (C3IL)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/21/87	264	M	3563	690	A	0.483		
09/22/87	265	T	3561	102	B	0.365		
09/23/87	266	W	3592	660	D	0.273		
09/24/87	267	H	3646	686	C	0.205		
09/25/87	268	F	3651	50	C	0.060		
09/29/87	272	T	3725	20	C	0.275		
09/30/87	273	W	3759	681	C	0.250		0.261

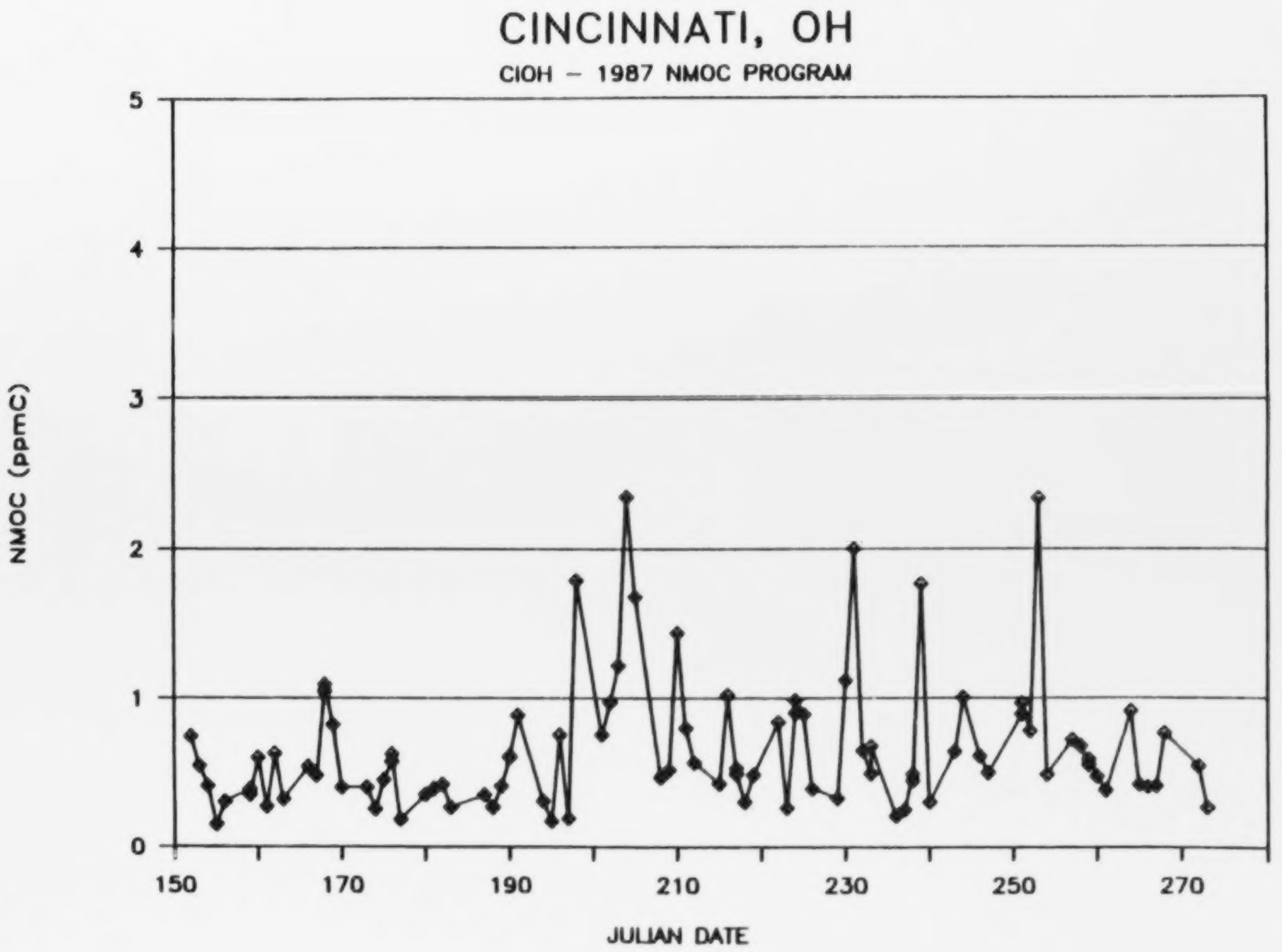

Figure 2-14. Plot of NMOC concentration for Cincinnati, OH.

TABLE 2-17. SUMMARY OF THE 1987 NMOC DATA FOR CINCINNATI, OH (CIOH)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1004	20	D	0.745		
06/02/87	153	T	1038	122	D	0.545		
06/03/87	154	W	1070	644	C	0.409		
06/04/87	155	H	1054	165	A	0.152		
06/04/87	155	H	1054	165	D	0.152		
06/05/87	156	F	1120	53	A	0.304		
06/08/87	159	M	1103	91	B	0.388		
06/08/87	159	M	1103	91	B	0.352		
06/09/87	160	T	1165	102	C	0.600		
06/10/87	161	W	1170	11	D	0.272		
06/11/87	162	H	1234	676	D	0.628		
06/12/87	163	F	1238	305	C	0.321		
06/15/87	166	M	1276	33	C	0.540		
06/16/87	167	T	1318	120	C	0.479		
06/17/87	168	W	1338	56	A	1.044		
06/17/87	168	W	1339	79	D	1.094		1.209
06/18/87	169	H	1394	677	A	0.822		
06/19/87	170	F	1395	166	A	0.401		
06/22/87	173	M	1406	74	C	0.401		
06/23/87	174	T	1458	653	D	0.255		
06/24/87	175	W	1492	145	A	0.453		0.403
06/25/87	176	H	1495	48	A	0.574		
06/25/87	176	H	1495	48	C	0.627		
06/26/87	177	F	1525	160	B	0.186		
06/29/87	180	M	1592	683	D	0.355	0.375	0.312
06/30/87	181	T	1626	404	C	0.394		
07/01/87	182	W	1628	500	D	0.421		
07/02/87	183	H	1653	107	D	0.267		
07/06/87	187	M	1721	1	C	0.351		
07/07/87	188	T	1786	714	B	0.268		
08/08/87	189	W	1805	695	C	0.410		
07/09/87	190	H	1847	151	C	0.605		
07/09/87	190	H	1848	13	D	0.614		
07/10/87	191	F	1864	716	C	0.887		
07/13/87	194	M	1896	96	D	0.308		
07/14/87	195	T	1921	696	A	0.173		
07/15/87	196	W	1971	135	C	0.755	0.623	0.574
07/16/87	197	H	2012	39	A	0.193		
07/17/87	198	F	2029	676	D	1.788		
07/20/87	201	M	2079	664	B	0.755		
07/21/87	202	T	2092	44	B	0.972		
07/22/87	203	W	2132	164	A	1.220		
07/23/87	204	H	2210	9	C	2.348		

TABLE 2-17. SUMMARY OF THE 1987 NMOC DATA FOR CINCINNATI, OH (CIOH)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/24/87	205	F	2188	705	D	1.681	1.694	1.795
07/27/87	208	M	2253	684	A	0.474		
07/27/87	208	M	2254	714	D	0.470		
07/28/87	209	T	2270	33	B	0.519		0.503
07/29/87	210	W	2283	68	C	1.438		
07/30/87	211	H	2354	686	C	0.801		
07/31/87	212	F	2351	672	D	0.567		
08/03/87	215	M	2389	91	C	0.426		
08/04/87	216	T	2405	682	C	1.023		
08/05/87	217	W	2428	143	D	0.530		
08/05/87	217	W	2428	143	C	0.492		
08/06/87	218	H	2483	728	C	0.303	0.333	
08/07/87	219	F	2534	684	B	0.486		
08/10/87	222	M	2544	75	B	0.839		
08/11/87	223	T	2590	642	D	0.265		
08/12/87	224	W	2580	761	A	0.903		
08/12/87	224	W	2580	761	D	0.985		
08/13/87	225	H	2660	791	A	0.893		
08/14/87	226	F	2651	87	D	0.392		
08/17/87	229	M	2746	40	A	0.328		
08/18/87	230	T	2713	41	D	1.121		
08/19/87	231	W	2794	183	A	2.003		
08/20/87	232	H	2827	184	D	0.648	0.631	
08/21/87	233	F	2863	650	A	0.495		
08/21/87	233	F	2864	766	C	0.679		
08/24/87	236	M	2887	12	A	0.212		
08/25/87	237	T	2920	111	A	0.253		
08/26/87	238	W	2953	773	D	0.492		
08/26/87	238	W	2953	773	A	0.446		
08/27/87	239	H	3004	66	A	1.767		
08/28/87	240	F	2989	19	C	0.304		
08/31/87	243	M	3065	799	C	0.642	0.578	
09/01/87	244	T	3078	169	A	1.006		
09/03/87	246	H	3183	623	A	0.613		
09/04/87	247	F	3144	723	D	0.501		
09/08/87	251	T	3239	655	A	0.893		
09/08/87	251	T	3240	123	D	0.966		
09/09/87	252	W	3261	146	C	0.781		
09/10/87	253	H	3289	773	D	2.339		
09/11/87	254	F	3310	39	D	0.489		0.402
09/14/87	257	M	3350	139	B	0.722		
09/15/87	258	T	3386	34	B	0.680		
09/16/87	259	W	3441	50	D	0.550		

TABLE 2-17. SUMMARY OF THE 1987 NMOC DATA FOR CINCINNATI, OH (CIOH)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/16/87	259	W	3442	90	D	0.591		
09/17/87	260	H	3446	775	C	0.475		
09/18/87	261	F	3451	141	B	0.381		0.330
09/21/87	264	M	3515	137	C	0.917		
09/22/87	265	T	3553	701	C	0.423		0.287
09/23/87	266	W	3579	409	D	0.406		
09/24/87	267	H	3652	714	D	0.413		
09/25/87	268	F	3619	782	D	0.767		
09/29/87	272	T	3730	695	D	0.545		
09/30/87	273	W	3760	77	C	0.270		

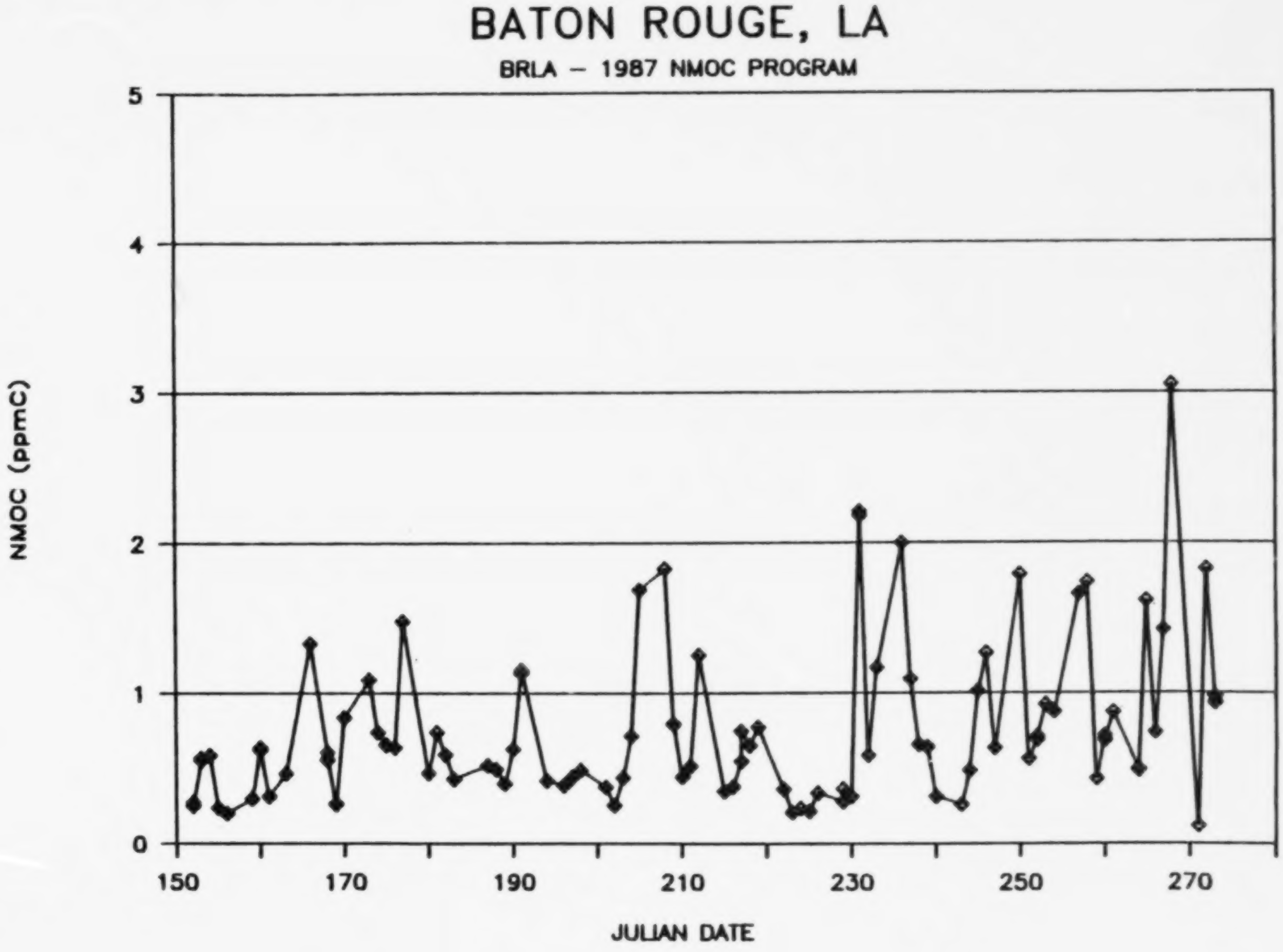

Figure 2-15. Plot of NMOC concentration for Baton Rouge, LA.

TABLE 2-18. SUMMARY OF THE 1987 NMOC DATA FOR BATON ROUGE, LA (BRLA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1000	70	A	0.277		
06/01/87	152	M	1000	70	A	0.253		
06/02/87	153	T	1011	11	A	0.570		
06/02/87	153	T	1011	11	B	0.552		
06/03/87	154	W	1039	44	B	0.586		
06/04/87	155	H	1084	134	C	0.240		
06/05/87	156	F	1089	136	A	0.203		
06/08/87	159	M	1121	62	C	0.301		
06/09/87	160	T	1154	663	D	0.639		
06/09/87	160	T	1174	106	D	0.621		0.651
06/10/87	161	W	1203	130	D	0.315		
06/12/87	163	F	1278	306	D	0.467		
06/15/87	166	M	1277	185	C	1.332		
06/17/87	168	T	1303	21	D	0.606		
06/17/87	168	T	1303	21	A	0.557		
06/18/87	169	H	1359	27	B	0.266		
06/18/87	169	H	1360	35	B	0.263		
06/19/87	170	F	1385	658	D	0.837		
06/22/87	173	M	1410	44	D	1.089		
06/23/87	174	T	1443	61	D	0.738	0.713	0.733
06/24/87	175	W	1483	165	B	0.654		
06/25/87	176	H	1507	183	B	0.637		
06/26/87	177	F	1531	650	D	1.477		
06/29/87	180	M	1581	184	C	0.469		
06/30/87	181	T	1623	66	B	0.740		
07/01/87	182	W	1640	188	C	0.589		
07/02/87	183	H	1654	197	C	0.430		
07/06/87	187	M	1726	55	A	0.519		
07/07/87	188	T	1745	60	C	0.495		
07/08/87	189	W	1832	177	A	0.398		
07/09/87	190	H	1833	406	D	0.628		
07/10/87	191	F	1853	37	D	1.134		
07/10/87	191	F	1854	668	D	1.154		
07/13/87	194	M	1897	181	C	0.419		
07/15/87	196	W	1941	162	C	0.387		
07/16/87	197	H	2010	654	A	0.444		
07/17/87	198	F	1994	718	A	0.489	0.536	0.462
07/20/87	201	M	2046	197	C	0.377	0.405	0.341
07/21/87	202	T	2090	38	B	0.257		
07/22/87	203	W	2155	136	D	0.440		
07/23/87	204	H	2200	644	C	0.715		
07/24/87	205	F	2194	142	B	1.687		
07/27/87	208	M	2219	30	C	1.829		

TABLE 2-18. SUMMARY OF THE 1987 NMOC DATA FOR BATON ROUGE, LA (BRLA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/28/87	209	T	2248	129	B	0.801		
07/28/87	209	T	2249	120	B	0.793		
07/29/67	210	W	2262	691	D	0.446	0.461	0.507
07/30/87	211	H	2313	302	D	0.518		
07/31/87	212	F	2350	173	A	1.252		
08/03/87	215	M	2373	118	B	0.351		
08/03/87	215	M	2373	118	A	0.352		
08/04/87	216	T	2408	40	B	0.380		
08/05/87	217	W	2427	779	B	0.547		
08/05/87	217	W	2427	779	C	0.748		
08/06/87	218	H	2462	725	D	0.653		
08/07/87	219	F	2512	122	B	0.772		
08/10/87	222	M	2551	667	A	0.362		
08/11/87	223	T	2574	126	B	0.209		
08/12/87	224	W	2625	662	B	0.235	0.270	
08/13/87	225	H	2685	676	C	0.215		
08/14/87	226	F	2670	111	A	0.337		
08/17/87	229	M	2716	136	C	0.280		
08/17/87	229	M	2731	792	D	0.366		
08/18/87	230	T	2755	82	B	0.316		
08/19/87	231	W	2785	17	A	2.210		2.404
08/19/87	231	W	2785	17	A	2.180		
08/20/87	232	H	2852	131	A	0.586		
08/21/87	233	F	2840	57	B	1.170		
08/24/87	236	M	2951	33	B	2.000	2.160	
08/25/87	237	T	2942	780	A	1.095		
08/26/87	238	W	2915	769	B	0.657		
08/27/87	239	H	2979	302	A	0.640	0.691	
08/28/87	240	F	3007	713	A	0.316		
08/31/87	243	M	3051	671	D	0.260		
09/01/87	244	T	3090	683	C	0.485		
09/02/87	245	W	3131	782	D	1.014		
09/03/87	246	H	3109	802	B	1.266		
09/04/87	247	F	3161	652	C	0.635		
09/07/87	250	M	3202	38	A	1.790		
09/08/87	251	T	3200	193	B	0.566		
09/09/87	252	W	3257	42	B	0.688		
09/09/87	252	W	3258	186	B	0.713		
09/10/87	253	H	3302	3	A	0.924		
09/11/87	254	F	3283	710	D	0.875		0.868
09/14/87	257	M	3355	686	A	1.659		
09/15/87	258	T	3379	632	D	1.740		1.705
09/16/87	259	W	3403	722	C	0.431		

TABLE 2-18. SUMMARY OF THE 1987 NMOC DATA FOR BATON ROUGE, LA (BRLA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/17/87	260	H	3497	184	A	0.718		
09/17/87	260	H	3498	25	A	0.686		
09/18/87	261	F	3450	699	B	0.874		
09/21/87	264	M	3510	30	D	0.496		
09/21/87	264	M	3510	30	D	0.489		
09/22/87	265	T	3547	689	B	1.615		
09/23/87	266	W	3580	21	D	0.738		
09/24/87	267	H	3649	792	D	1.424		
09/25/87	268	F	3616	687	A	3.053		
09/28/87	271	M	3691	68	C	0.121	0.591	0.590
09/29/87	272	T	3688	635	A	1.826		
09/30/87	273	W	3757	694	A	0.978		
09/30/87	273	W	3758	192	B	0.936		

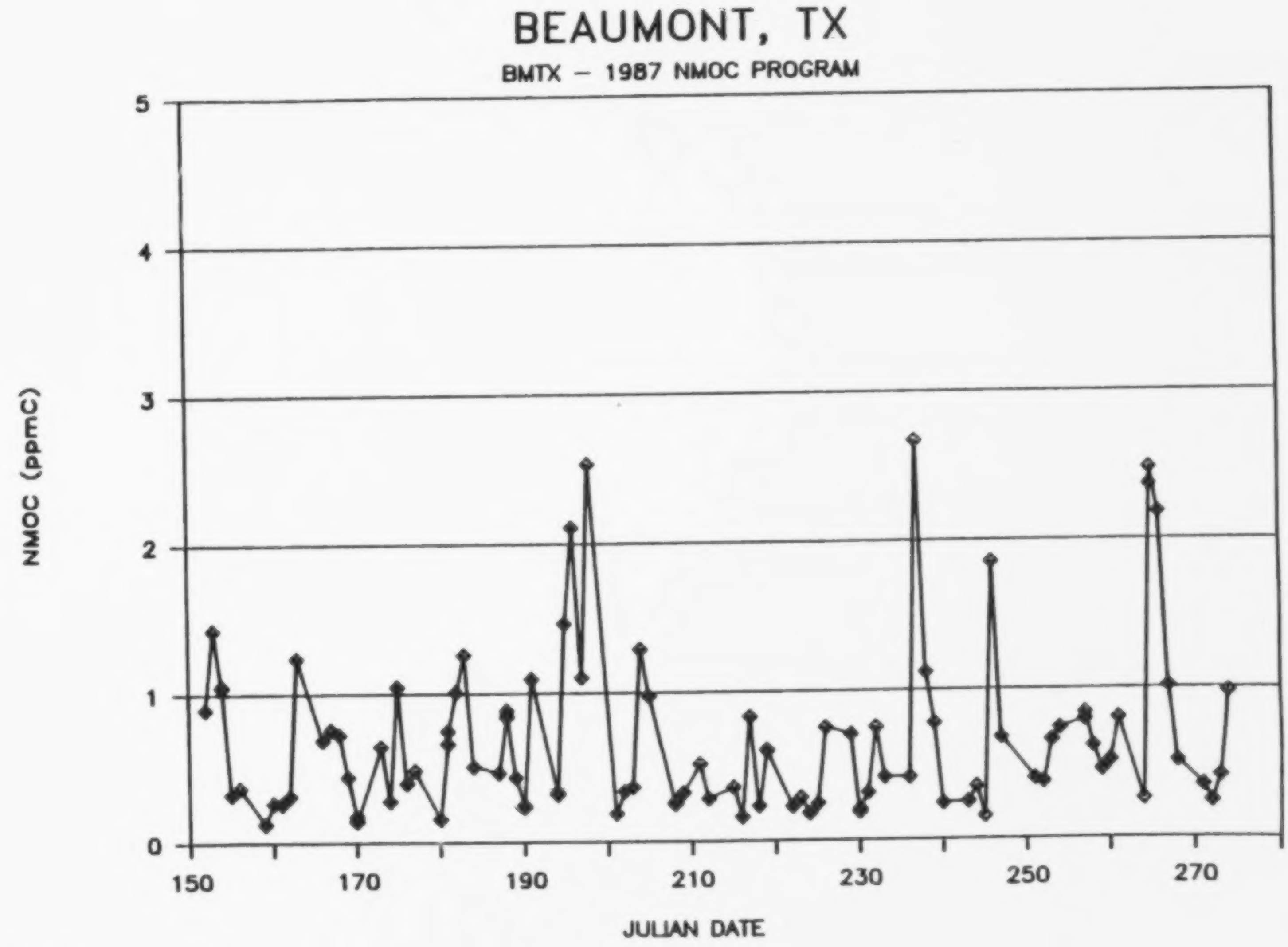

Figure 2-16. Plot of NMOC concentration for Beaumont, TX.

TABLE 2-19. SUMMARY OF THE 1987 NMOC DATA FOR BEAUMONT, TX (BMTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1007	17	C	0.899		
06/02/87	153	T	1021	130	A	1.431		
06/03/87	154	W	1074	190	C	1.046		
06/03/87	154	W	1074	190	C	1.056		
06/04/87	155	H	1066	186	C	0.330		
06/05/87	156	F	1101	34	A	0.371		
06/08/87	159	M	1122	80	C	0.128		
06/09/87	160	T	1130	32	C	0.271	0.335	0.274
06/10/87	161	W	1190	150	B	0.263		
06/11/87	162	H	1206	49	D	0.318		
06/12/87	163	F	1223	27	B	1.238		
06/15/87	166	M	1264	181	C	0.690		0.618
06/16/87	167	T	1291	77	C	0.760		
06/17/87	168	W	1331	182	B	0.727		
06/18/87	169	H	1354	13	C	0.445		
06/19/87	170	F	1426	683	B	0.180		
06/19/87	170	F	1427	170	C	0.146		
06/22/87	173	M	1416	66	D	0.647		
06/23/87	174	T	1440	702	A	0.281		
06/24/87	175	W	1471	30	C	1.047		1.009
06/25/87	176	H	1542	14	C	0.403		
06/26/87	177	F	1540	657	B	0.486		
06/29/87	180	M	1598	670	D	0.159		
06/30/87	181	T	1608	115	D	0.666		
06/30/87	181	T	1608	115	B	0.751		
07/01/87	182	W	1656	647	A	1.011		
07/02/87	183	H	1678	721	A	1.258		
07/03/87	184	F	1722	148	D	0.512		
07/06/87	187	M	1727	30	B	0.470		
07/07/87	188	T	1770	56	C	0.843		
07/07/87	188	T	1770	56	B	0.886		
07/08/87	189	W	1779	182	D	0.439		0.647
07/09/87	190	H	1820	50	C	0.251		
07/09/87	190	H	1821	93	D	0.235		
07/10/87	191	F	1883	656	C	1.096		
07/13/87	194	M	1870	163	B	0.333		
07/13/87	194	M	1870	163	B	0.320		
07/14/87	195	T	1904	681	C	1.466		
07/15/87	196	W	1944	19	B	2.109		
07/16/87	197	H	2027	660	D	1.105		
07/17/87	198	F	2040	305	A	2.534		
07/20/87	201	M	2044	184	B	0.192	0.298	0.262
07/21/87	202	T	2101	54	C	0.341	0.286	0.426

TABLE 2-19. SUMMARY OF THE 1987 NMOC DATA FOR BEAUMONT, TX (BMTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/22/87	203	W	2146	188	B	0.367		
07/23/87	204	H	2207	681	A	1.289		
07/24/87	205	F	2192	99	A	0.976		
07/27/87	208	M	2211	55	C	0.263		
07/27/87	208	M	2211	55	D	0.254		
07/28/87	209	T	2255	13	A	0.328		
07/30/87	211	H	2291	694	B	0.520	0.507	0.444
07/31/87	212	F	2330	405	B	0.286		
08/03/87	215	M	2375	693	D	0.363		
08/04/87	216	T	2401	92	D	0.163		
08/05/87	217	W	2138	773	D	0.832		
08/06/87	218	H	2522	154	C	0.235		
08/07/87	219	F	2487	683	A	0.609	0.666	
08/07/87	219	F	2488	638	C	0.603		
08/10/87	222	M	2543	301	D	0.231	0.202	
08/11/87	223	T	2608	770	B	0.288		
08/12/87	224	W	2600	501	C	0.183		
08/13/87	225	H	2631	305	B	0.249		
08/14/87	226	F	2664	4	B	0.756		
08/17/87	229	M	2729	308	D	0.712		
08/18/87	230	T	2736	706	D	0.192		
08/18/87	230	T	2740	680	D	0.212		
08/19/87	231	W	2796	129	B	0.321		
08/20/87	232	H	2845	500	C	0.756		
08/21/87	233	F	2820	114	B	0.423		
08/24/87	236	M	2891	143	D	0.421		
08/25/87	237	T	2884	787	A	2.670	2.762	2.859
08/26/87	238	W	2965	770	A	1.118		
08/27/87	239	H	3000	788	B	0.779		
08/28/87	240	F	3014	139	B	0.244		
08/31/87	243	M	3049	87	B	0.253		
09/01/87	244	T	3076	92	D	0.355		
09/02/87	245	W	3111	55	A	0.155	0.354	
09/03/87	246	H	3114	40	C	1.855		
09/04/87	247	F	3145	189	B	0.679		
09/08/87	251	T	3205	636	D	0.405		
09/09/87	252	W	3276	728	C	0.381		
09/10/87	253	H	3277	72	B	0.660		
09/10/87	253	H	3278	20	C	0.661		
09/11/87	254	F	3304	105	D	0.737		0.741
09/14/87	257	M	3360	183	C	0.796		0.806
09/14/87	257	M	3375	46	C	0.840		
09/15/87	258	T	3391	27	D	0.617		

TABLE 2-19. SUMMARY OF THE 1987 NMOC DATA FOR BEAUMONT, TX (BMTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/16/87	259	W	3420	680	D	0.462		
09/17/87	260	H	3445	37	A	0.520		
09/17/87	260	H	3445	37	B	0.526		
09/18/87	261	F	3466	64	B	0.804		
09/21/87	264	M	3528	15	B	0.263		
09/22/87	265	T	3542	667	D	2.369		
09/22/87	265	T	3542	667	B	2.479		
09/23/87	266	W	3595	7	A	2.183		
09/24/87	267	H	3626	36	D	1.013		
09/25/87	268	F	3623	86	A	0.516		
09/28/87	271	M	3687	119	A	0.353		
09/29/87	272	T	3712	768	C	0.247		
09/30/87	273	W	3754	9	C	0.418		0.395
10/01/87	274	H	3811	10	D	0.977		
10/01/87	274	H	3812	762	A	0.961		

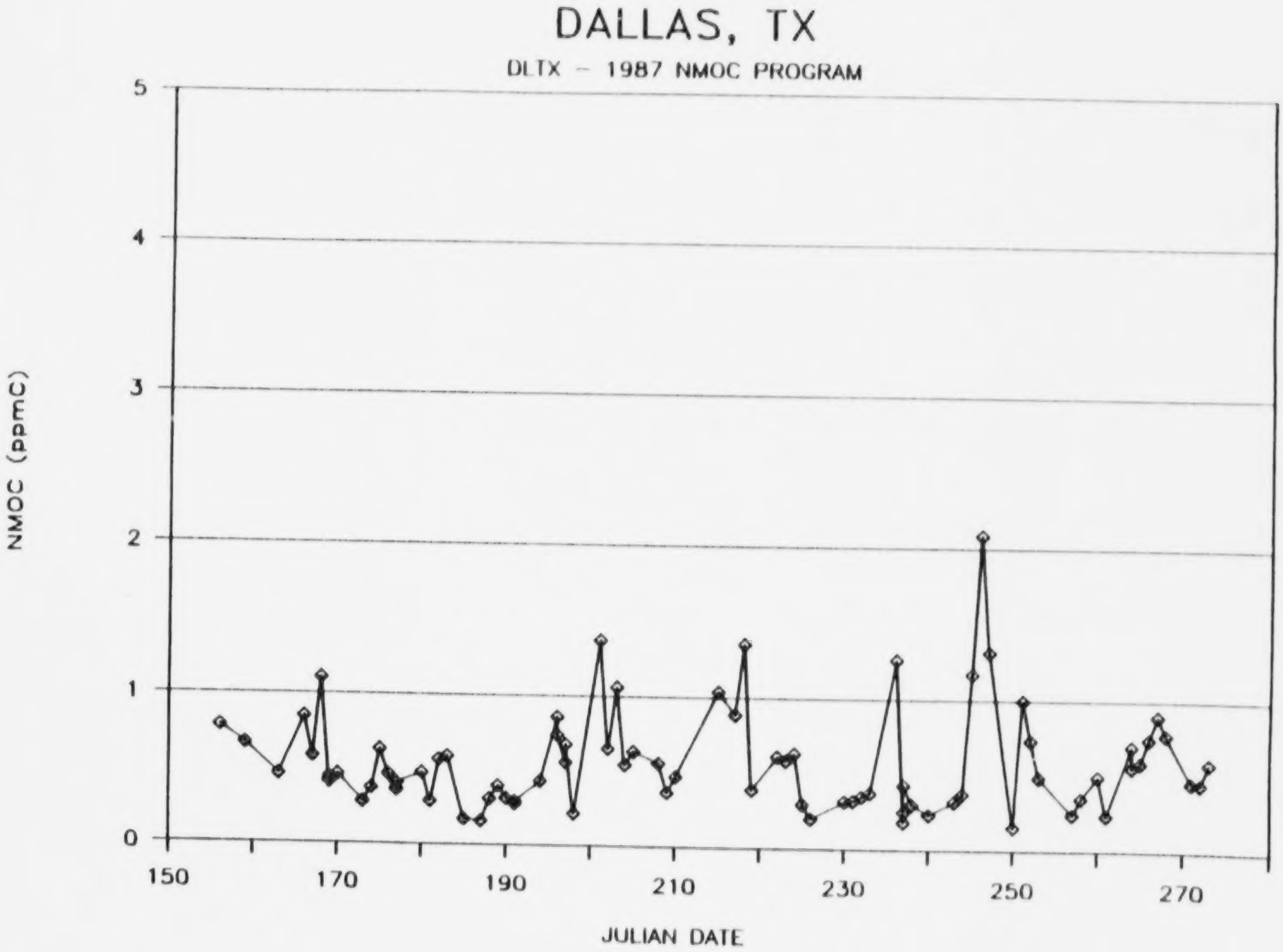

Figure 2-17. Plot of NMOC concentration for Dallas, TX.

TABLE 2-20. SUMMARY OF THE 1987 NMOC DATA FOR DALLAS, TX (DLTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/05/87	156	F	1098	166	C	0.785		
06/08/87	159	M	1138	145	C	0.667		
06/12/87	163	F	1287	143	B	0.460		
06/15/87	166	M	1317	54	C	0.847		
06/16/87	167	T	1301	103	A	0.583		
06/16/87	167	T	1301	103	D	0.583		
06/17/87	168	W	1392	404	D	1.106		
06/18/87	169	H	1433	102	B	0.444		
06/18/87	169	H	1433	102	B	0.414		
06/19/87	170	F	1486	197	C	0.464		
06/22/87	173	M	1482	97	B	0.280		
06/23/87	174	T	1545	682	C	0.375		
06/24/87	175	W	1549	119	C	0.632		
06/25/87	176	H	1612	410	C	0.465		
06/26/87	177	H	1649	15	A	0.361		
06/26/87	177	F	1650	645	A	0.407		
06/29/87	180	M	1643	725	A	0.478		
06/30/87	181	T	1735	24	D	0.288		
07/01/87	182	W	1755	133	D	0.567		
07/02/87	183	H	1750	308	A	0.590		
07/04/87	185	S	1748	77	D	0.171		
07/06/87	187	M	1749	53	D	0.160		
07/07/87	188	T	1857	175	C	0.310		
07/08/87	189	W	1861	129	B	0.396		
07/09/87	190	H	1970	86	C	0.311		
07/10/87	191	F	1967	666	D	0.278		
07/10/87	191	F	1967	666	A	0.293		
07/13/87	194	M	2005	173	D	0.431		
07/15/87	196	W	1985	77	D	0.859		
07/15/87	196	W	1985	77	D	0.738		
07/16/87	197	H	2061	10	B	0.555		
07/16/87	197	H	2062	122	C	0.676		
07/17/87	198	F	2160	87	B	0.216		
07/20/87	201	M	2143	722	D	1.371		
07/21/87	202	T	2178	194	C	0.653		
07/22/87	203	W	2205	155	C	1.062		
07/23/87	204	H	2243	107	C	0.544		
07/24/87	205	F	2328	656	D	0.635		
07/27/87	208	M	2329	726	D	0.558		0.560
07/28/87	209	T	2321	666	A	0.364		
07/29/87	210	W	2352	50	D	0.471		
08/03/87	215	M	2471	83	D	1.040		
08/05/87	217	W	2578	705	A	0.887		

TABLE 2-20. SUMMARY OF THE 1987 NMOC DATA FOR DALLAS, TX (DLTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/06/87	218	H	2575	708	B	1.356		
08/07/87	219	F	2560	141	C	0.391	0.466	
08/10/87	222	M	2686	719	A	0.613		
08/11/87	223	T	2689	699	C	0.584		
08/12/87	224	W	2661	652	D	0.634		
08/13/87	225	H	2752	139	B	0.299		
08/14/87	226	F	2725	145	D	0.201		
08/18/87	230	T	2795	691	B	0.320		
08/19/87	231	W	2793	45	D	0.323		
08/20/87	232	H	2849	141	D	0.352		
08/21/87	233	F	2869	25	A	0.376		
08/24/87	236	M	2880	776	C	1.263		
08/25/87	237	T	2971	663	B	0.253		
08/25/87	237	T	2972	123	B	0.184		
08/25/87	237	T	2932	18	B	0.429		
08/26/87	238	W	2982	56	B	0.302		
08/28/87	240	F	3006	676	B	0.235		
08/31/87	243	M	3057	640	D	0.322		
09/01/87	244	T	3071	158	D	0.377	0.364	
09/02/87	245	W	3123	693	D	1.173		
09/03/87	246	H	3177	663	C	2.087		
09/04/87	247	F	3178	764	A	1.318		
09/07/87	250	M	3228	56	C	0.159		
09/08/87	251	T	3259	143	D	1.000		0.950
09/09/87	252	W	3322	83	D	0.733		
09/10/87	253	H	3312	808	D	0.489		
09/14/87	257	M	3393	653	B	0.244		
09/15/87	258	T	3434	140	A	0.350		
09/17/87	260	H	3481	118	B	0.496		
09/18/87	261	F	3516	410	B	0.239		0.218
09/21/87	264	M	3572	8	A	0.700		
09/21/87	264	M	3573	32	C	0.558		
09/22/87	265	T	3587	769	A	0.589		
09/23/87	266	W	3622	401	B	0.748		
09/24/87	267	H	3611	156	D	0.902		0.809
09/25/87	268	F	3696	101	A	0.774		0.811
09/28/87	271	M	3715	92	C	0.460		0.411
09/29/87	272	T	3753	684	D	0.451		0.459
09/30/87	273	W	3806	181	D	0.586		

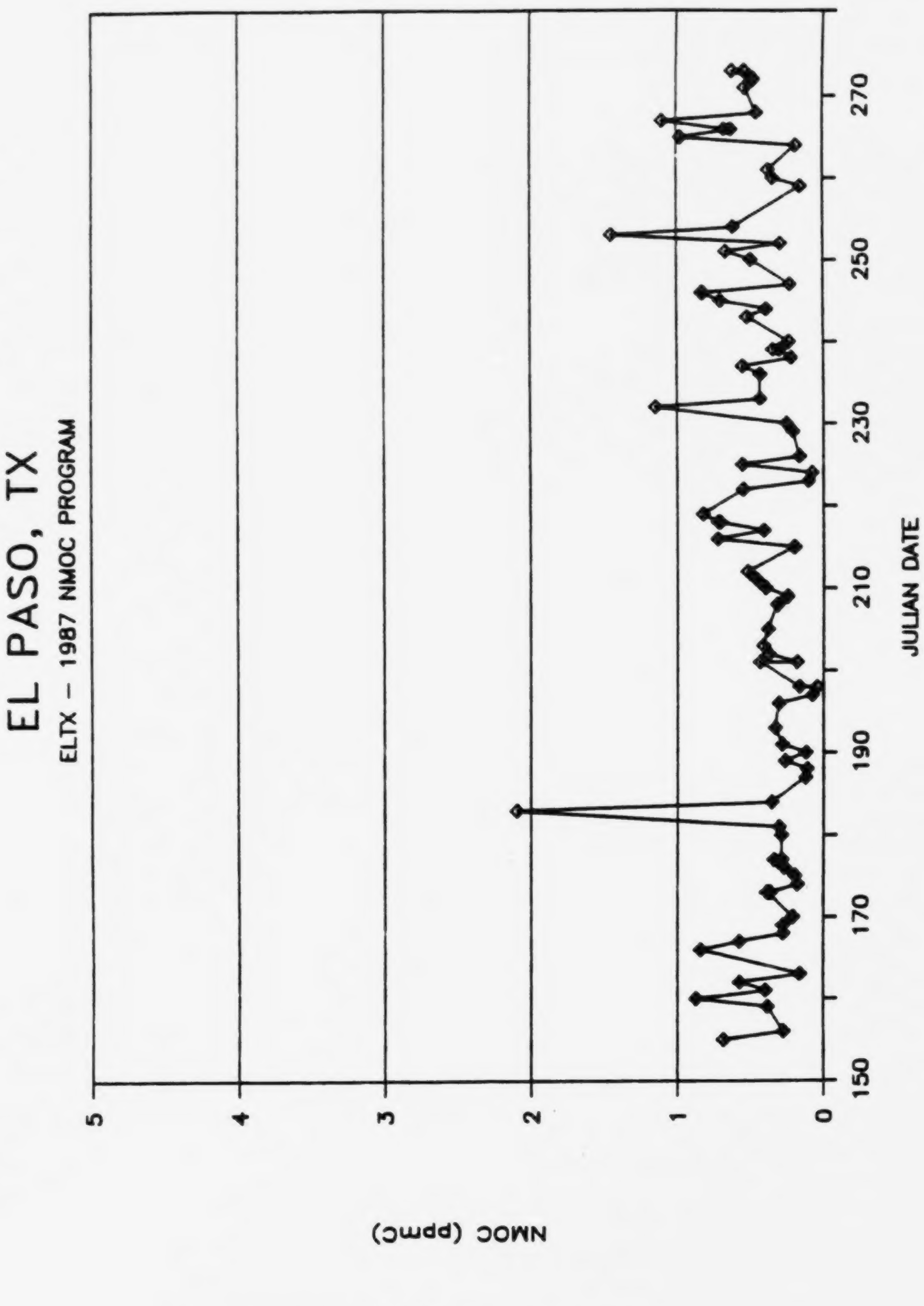

Figure 2-18. Plot of NMOC concentration for El Paso, TX.

TABLE 2-21. SUMMARY OF THE 1987 NMOC DATA FOR EL PASO, TX (ELTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1027	188	C	0.394		
06/02/87	153	T	1028	149	B	0.250		
06/02/87	153	T	1029	6	D	0.057		
06/04/87	155	H	1059	66	D	0.686		0.870
06/05/87	156	F	1078	155	D	0.275	0.323	0.225
06/08/87	159	M	1109	179	C	0.385		
06/09/87	160	T	1157	93	C	0.875		
06/10/87	161	W	1168	176	D	0.398		
06/11/87	162	H	1210	105	C	0.573		
06/12/87	163	F	1224	14	D	0.162		
06/15/87	166	M	1265	71	D	0.844		
06/16/87	167	T	1293	653	C	0.575		
06/17/87	168	W	1304	189	B	0.278	0.296	0.280
06/18/87	169	H	1336	164	D	0.279		
06/19/87	170	F	1391	116	C	0.210		
06/22/87	173	M	1401	694	A	0.388		
06/22/87	173	M	1401	694	A	0.367		
06/23/87	174	T	1448	701	D	0.180		
06/24/87	175	W	1472	35	A	0.196		
06/25/87	176	H	1557	46	C	0.269		
06/26/87	177	F	1534	658	A	0.340		
06/26/87	177	F	1535	100	A	0.286		
06/29/87	180	M	1593	126	C	0.289		
06/30/87	181	T	1622	671	A	0.305		
07/02/87	183	H	1670	173	D	2.095		
07/03/87	184	F	1695	78	C	0.357		
07/06/87	187	M	1723	661	D	0.123		
07/07/87	188	T	1768	138	D	0.111		
07/08/87	189	W	1818	725	B	0.264		
07/09/87	190	H	1815	183	A	0.121		
07/10/87	191	F	1856	654	C	0.285		
07/14/87	193	T	1918	22	D	0.332		
07/15/87	196	W	1943	701	C	0.305		
07/16/87	197	H	2015	37	B	0.075		
07/17/87	198	F	1988	34	B	0.045		
07/17/87	198	F	1989	46	D	0.165		
07/20/87	201	M	2047	149	D	0.434		0.407
07/21/87	202	T	2114	102	C	0.183		
07/22/87	203	W	2091	170	D	0.376		
07/23/87	204	H	2191	191	A	0.413		
07/24/87	205	F	2189	729	B	0.383		
07/27/87	208	M	2224	645	D	0.320		
07/27/87	208	M	2224	645	D	0.316		

TABLE 2-21. SUMMARY OF THE 1987 NMOC DATA FOR EL PASO, TX (ELTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/28/87	209	T	2226	79	C	0.248	0.215	0.206
07/29/87	210	W	2304	39	B	0.398		
07/30/87	211	H	2355	73	C	0.460		
07/31/87	212	F	2325	99	D	0.520		
08/03/87	215	M	2374	157	D	0.204		
08/03/87	215	M	2374	157	A	0.196		0.155
08/04/87	216	T	2463	696	C	0.722		
08/05/87	217	W	2460	406	B	0.411		
08/06/87	218	H	2486	96	B	0.706		
08/06/87	218	H	2530	176	A	0.720		
08/07/87	219	F	2504	775	C	0.822		
08/10/87	222	M	2548	674	D	0.548		
08/11/87	223	T	2591	91	C	0.105		
08/12/87	224	W	2584	704	D	0.078	0.082	
08/13/87	225	H	2663	768	D	0.553		
08/14/87	226	F	2655	113	A	0.167		
08/17/87	229	M	2720	162	D	0.210		
08/18/87	230	T	2770	142	A	0.257		
08/20/87	232	H	2843	121	C	1.150		
08/21/87	233	F	2847	700	C	0.434		
08/24/87	236	M	2883	4	B	0.433		
08/25/87	237	T	2885	118	D	0.551		
08/26/87	238	W	2928	410	B	0.222		
08/27/87	239	H	3023	130	D	0.301		
08/27/87	239	H	3022	686	B	0.345		
08/28/87	240	F	3034	177	C	0.235		
08/31/87	243	M	3046	27	D	0.520		
09/01/87	244	T	3081	690	B	0.390		
09/02/87	245	W	3127	164	D	0.703		
09/03/87	246	H	3140	792	A	0.832		
09/03/87	246	H	3140	792	D	0.821		
09/04/87	247	F	3172	162	C	0.227		
09/07/87	250	M	3217	656	C	0.496		
09/08/87	251	T	3227	642	C	0.667		
09/09/87	252	W	3270	100	A	0.293		
09/10/87	253	H	3307	66	A	1.450		1.439
09/11/87	254	F	3373	158	C	0.614		
09/16/87	259	W	3468	101	A	0.155		
09/17/87	260	H	3470	678	A	0.343		
09/18/87	261	F	3483	96	B	0.375		
09/21/87	264	M	3534	673	C	0.184		
09/22/87	265	T	3557	193	C	0.974		0.804
09/23/87	266	W	3605	61	B	0.627		

TABLE 2-21. SUMMARY OF THE 1987 NMOC DATA FOR EL PASO, TX (ELTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/23/87	266	W	3606	722	B	0.673		
09/24/87	267	H	3614	666	A	1.100		
09/25/87	268	F	3676	13	D	0.453		
09/28/87	271	M	3692	49	B	0.534		
09/29/87	272	T	3721	178	C	0.476		
09/30/87	273	W	3776	784	B	0.622		
09/30/87	273	W	3777	62	A	0.537		

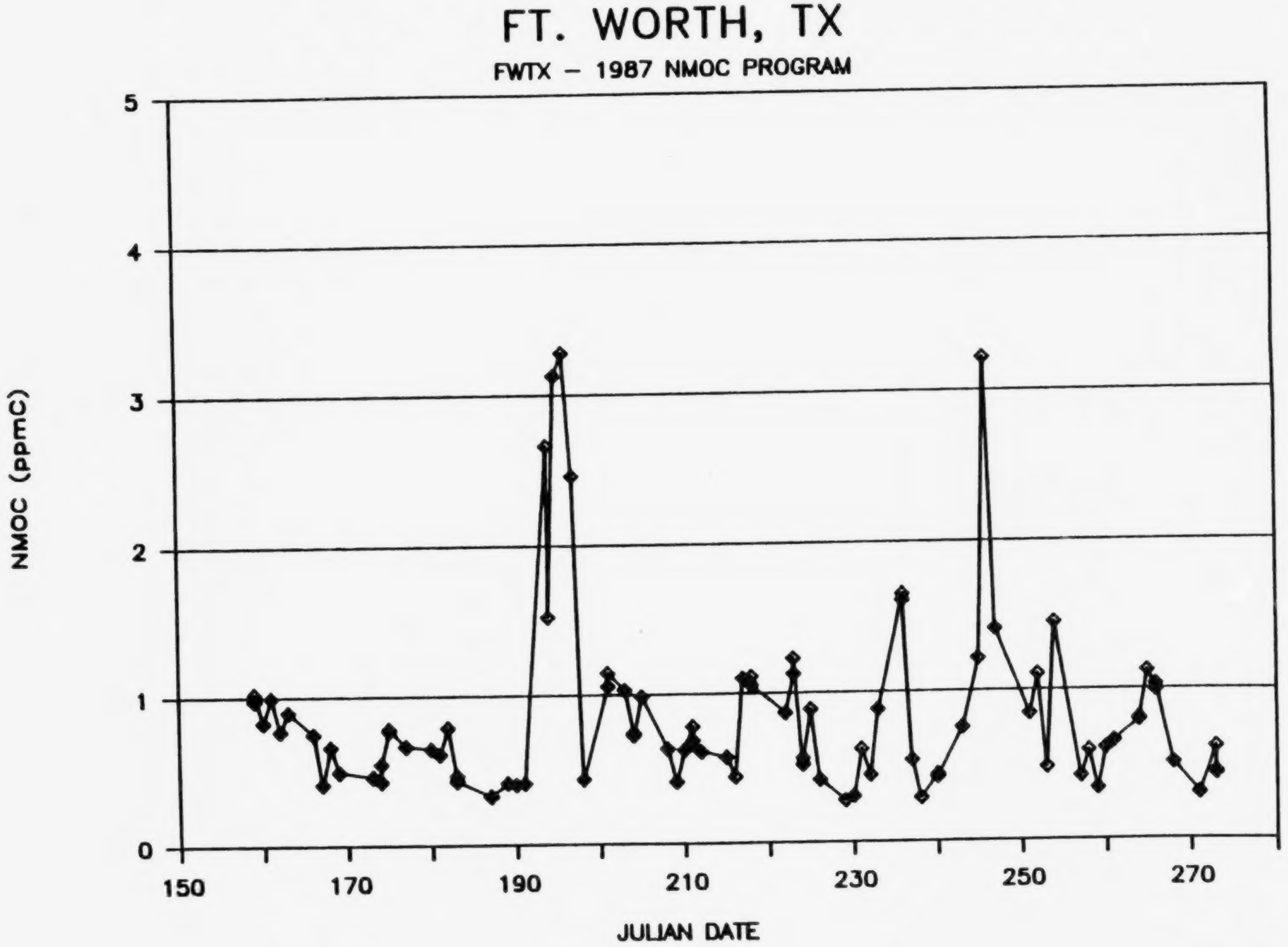

Figure 2-19. Plot of NMOC concentration for Fort Worth, TX.

TABLE 2-22. SUMMARY OF THE 1987 NMOC DATA FOR FT. WORTH, TX (FWTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/08/87	159	M	1112	156	A	0.976	0.998	1.183
06/08/87	159	M	1113	185	A	1.023		
06/09/87	160	T	1185	50	D	0.825		
06/10/87	161	W	1181	405	C	0.993		
06/11/87	162	H	1251	45	C	0.768		
06/12/87	163	F	1273	646	D	0.896		
06/15/87	166	M	1261	43	A	0.748	0.727	0.615
06/16/87	167	T	1313	108	D	0.414		
06/17/87	168	W	1350	10	D	0.660		
06/18/87	169	H	1378	146	B	0.493		
06/22/87	173	M	1407	98	D	0.461		
06/23/87	174	T	1462	92	C	0.431		
06/23/87	174	T	1463	7	C	0.545		
06/24/87	175	W	1494	669	A	0.766		
06/24/87	175	W	1494	669	B	0.782		
06/26/87	177	F	1533	101	B	0.663		
06/29/87	180	M	1591	192	C	0.645	0.481	0.516
06/30/87	181	T	1630	685	C	0.609		
07/01/87	182	W	1664	63	C	0.787		
07/02/87	183	H	1685	141	B	0.465		
07/02/87	183	H	1685	141	D	0.430		
07/06/87	187	M	1731	713	A	0.327		
07/06/87	187	M	1731	713	A	0.328		
07/08/87	189	W	1802	165	D	0.417		
07/09/87	190	H	1884	131	A	0.405		
07/10/87	191	F	1860	651	C	0.413		
07/13/87	194	M	1923	655	A	2.659		
07/13/87	194	M	1924	705	C	1.523		
07/14/87	195	T	1939	699	D	3.126		
07/15/87	196	W	1981	728	D	3.278		3.358
07/16/87	197	H	2041	70	B	2.460		
07/17/87	198	F	2006	653	D	0.438		
07/20/87	201	M	2063	183	A	1.056		
07/20/87	201	M	2063	183	C	1.145		
07/22/87	203	W	2151	709	C	1.032		
07/23/87	204	H	2154	80	B	0.742		
07/23/87	204	H	2154	80	B	0.728		
07/24/87	205	F	2209	700	D	0.985		
07/27/87	208	M	2233	712	D	0.636		
07/28/87	209	T	2271	130	D	0.416		
07/29/87	210	W	2307	671	D	0.626		
07/30/87	211	H	2315	37	A	0.782		
07/30/87	211	H	2315	37	C	0.687		

TABLE 2-22. SUMMARY OF THE 1987 NMOC DATA FOR FT. WORTH, TX (FWTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/31/87	212	F	2342	93	A	0.613		
08/03/87	215	M	2379	724	D	0.572	0.590	0.487
08/04/87	216	T	2447	160	B	0.445		
08/05/87	217	W	2474	43	A	1.102		
08/06/87	218	H	2481	45	B	1.112		
08/06/87	218	H	2501	196	A	1.054		
08/10/87	222	M	2565	163	C	0.866		
08/11/87	223	T	2581	99	C	1.127		
08/11/87	223	T	2581	99	C	1.231		
08/12/87	224	W	2642	401	A	0.521		
08/12/87	224	W	2642	401	D	0.561		
08/13/87	225	H	2654	86	B	0.887		
08/14/87	226	F	2684	685	C	0.418		
08/17/87	229	M	2719	62	D	0.277		
08/18/87	230	T	2769	151	A	0.305		
08/19/87	231	W	2807	639	B	0.617		
08/20/87	232	H	2830	153	D	0.446		
08/21/87	233	F	2837	96	B	0.882		
08/24/87	236	M	2874	156	D	1.651		
08/24/87	236	M	2874	156	C	1.610		
08/25/87	237	T	2948	694	C	0.541		
08/26/87	238	W	2961	701	C	0.289		
08/28/87	240	F	3024	400	C	0.448		
08/28/87	240	F	3025	198	C	0.430		
08/31/87	243	M	3061	666	C	0.757		
09/02/87	245	W	3121	142	D	1.217		
09/03/87	246	H	3167	620	D	3.215		
09/04/87	247	F	3191	165	A	1.413		
09/08/87	251	T	3234	725	D	0.843		0.805
09/09/87	252	W	3263	198	A	1.106		
09/10/87	253	H	3290	685	B	0.487		
09/11/87	254	F	3340	767	D	1.451		
09/14/87	257	M	3372	781	B	0.424		
09/15/87	258	T	3425	638	A	0.593		
09/16/87	259	W	3411	652	A	0.342		
09/17/87	260	H	3464	108	D	0.606		
09/18/87	261	F	3453	178	A	0.654		0.679
09/21/87	264	M	3500	683	A	0.792		
09/21/87	264	M	3500	683	A	0.807		
09/22/87	265	T	3559	709	D	1.125		
09/23/87	266	W	3607	54	B	0.991		
09/23/87	266	W	3608	691	B	1.030		
09/25/87	268	F	3615	89	C	0.508		

TABLE 2-22. SUMMARY OF THE 1987 NMOC DATA FOR FT. WORTH, TX (FWTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/28/87	271	M	3701	165	B	0.307		
09/30/87	273	W	3733	626	D	0.611		
09/30/87	273	W	3751	500	B	0.434		
09/30/87	273	W	3751	500	B	0.448		

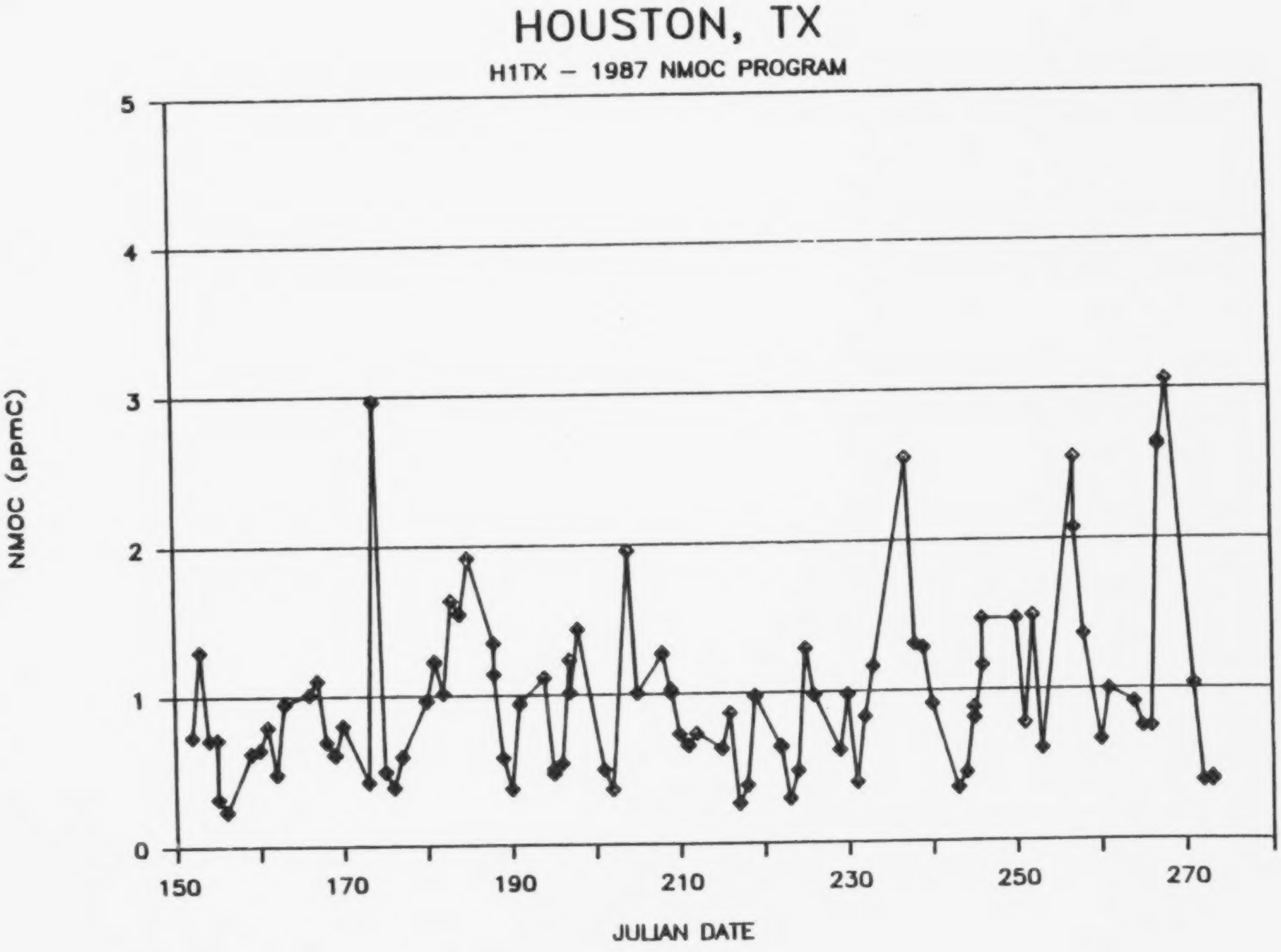

Figure 2-20. Plot of NMOC concentration for Houston, TX.

TABLE 2-23. SUMMARY OF THE 1987 NMOC DATA FOR HOUSTON, TX (H1TX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1002	173	D	0.735		
06/02/87	153	T	1014	163	D	1.304		
06/03/87	154	W	1068	101	B	0.713		
06/04/87	155	H	1060	405	C	0.716		
06/04/87	155	H	1061	400	D	0.323		
06/05/87	156	F	1095	72	D	0.237		
06/08/87	159	M	1106	33	D	0.624		
06/09/87	160	T	1144	307	C	0.646		
06/10/87	161	W	1192	1	D	0.798		
06/11/87	162	H	1201	186	B	0.482		
06/12/87	163	F	1227	136	D	0.951		
06/15/87	166	M	1256	91	B	1.013		
06/16/87	167	T	1298	119	A	1.108		
06/17/87	168	W	1306	142	C	0.696	0.734	
06/18/87	169	H	1334	32	B	0.614		
06/18/87	169	H	1334	32	B	0.610		
06/19/87	170	F	1377	31	A	0.802		
06/22/87	173	M	1421	91	D	0.427		
06/23/87	174	T	1437	686	B	2.967		
06/24/87	175	W	1484	32	C	0.500		
06/24/87	175	W	1485	164	D	0.494		
06/25/87	176	H	1524	715	C	0.391		
06/26/87	177	F	1526	677	A	0.595		
06/29/87	180	M	1575	187	A	0.966	1.016	1.055
06/30/87	181	T	1604	172	B	1.233		
06/30/87	181	T	1604	172	B	1.222		
07/01/87	182	W	1610	690	A	1.017	0.992	1.130
07/02/87	183	H	1657	121	B	1.636		
07/03/87	184	F	1706	682	A	1.544		
07/04/87	185	S	1728	108	D	1.918		
07/07/87	188	T	1732	700	C	1.351		
07/07/87	188	T	1732	700	B	1.142		
07/08/87	189	W	1787	116	A	0.584		
07/09/87	190	H	1800	723	D	0.376		0.411
07/10/87	191	F	1871	164	A	0.944		
07/13/87	194	M	1891	679	A	1.117		
07/14/87	195	T	1913	693	A	0.505		
07/14/87	195	T	1914	18	D	0.475	0.476	0.447
07/15/87	196	W	1938	406	C	0.545		
07/16/87	197	H	1987	145	A	1.234		
07/16/87	197	H	1987	145	A	1.017		
07/17/87	198	F	2009	27	C	1.437		
07/20/87	201	M	2052	64	D	0.499		

TABLE 2-23. SUMMARY OF THE 1987 NMOC DATA FOR HOUSTON, TX (H1TX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/21/87	202	T	2107	137	A	0.367		
07/23/87	204	H	2195	308	D	1.959		
07/24/87	205	F	2193	57	B	1.008	1.042	1.010
07/27/87	208	M	2214	657	D	1.267		
07/27/87	208	M	2214	657	D	1.275		
07/28/87	209	T	2223	6	A	1.007		
07/28/87	209	T	2223	6	A	1.031		
07/29/87	210	W	2269	96	C	0.731		
07/30/87	211	H	2335	409	A	0.655		
07/31/87	212	F	2359	308	D	0.734		0.849
08/03/87	215	M	2381	653	C	0.632		
08/04/87	216	T	2425	685	B	0.868		
08/05/87	217	W	2430	172	D	0.266		
08/06/87	218	H	2533	36	C	0.387		
08/07/87	219	F	2515	664	A	0.981		
08/07/87	219	F	2516	640	B	0.975		
08/10/87	222	M	2546	185	A	0.634		
08/10/87	222	M	2546	185	B	0.646		
08/11/87	223	T	2586	180	B	0.295	0.303	
08/12/87	224	W	2587	72	D	0.478		
08/13/87	225	H	2698	799	A	1.291		
08/14/87	226	F	2673	191	D	0.979		
08/17/87	229	M	2738	196	A	0.613		
08/18/87	230	T	2803	727	D	0.981		
08/19/87	231	W	2784	107	C	0.398		
08/20/87	232	H	2801	720	B	0.831		
08/21/87	233	F	2833	660	D	1.168		
08/25/87	237	T	2934	89	D	2.551		
08/26/87	238	W	2962	31	A	1.314		
08/27/87	239	H	3011	103	D	1.286		
08/28/87	240	F	3018	8	A	0.912		
08/31/87	243	M	3052	137	C	0.355		
09/01/87	244	T	3096	135	C	0.455		
09/02/87	245	W	3103	712	A	0.884		
09/02/87	245	W	3103	712	C	0.816		
09/03/87	246	H	3179	727	A	1.165		
09/03/87	246	H	3150	172	B	1.474	1.415	
09/07/87	250	M	3207	109	C	1.476		
09/08/87	251	T	3210	654	B	0.777		
09/09/87	252	W	3268	643	C	1.495		
09/10/87	253	H	3293	135	C	0.610		
09/14/87	257	M	3351	646	C	2.546		
09/14/87	257	M	3351	646	B	2.609		

TABLE 2-23. SUMMARY OF THE 1987 NMOC DATA FOR HOUSTON, TX (H1TX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/15/87	258	T	3378	133	D	1.369		
09/17/87	260	H	3480	707	A	0.662		
09/18/87	261	F	3477	138	C	0.999		
09/21/87	264	M	3537	186	D	0.911		
09/22/87	265	T	3597	637	C	0.748		
09/23/87	266	W	3588	10	C	0.747		
09/24/87	267	H	3609	308	B	2.621		
09/24/87	267	H	3610	121	C	2.642		
09/25/87	268	F	3628	407	D	3.060		3.261
09/28/87	271	M	3697	138	D	1.034		0.958
09/29/87	272	T	3756	145	A	0.387		
09/30/87	273	W	3739	137	C	0.387		
09/30/87	273	W	3740	197	B	0.408		

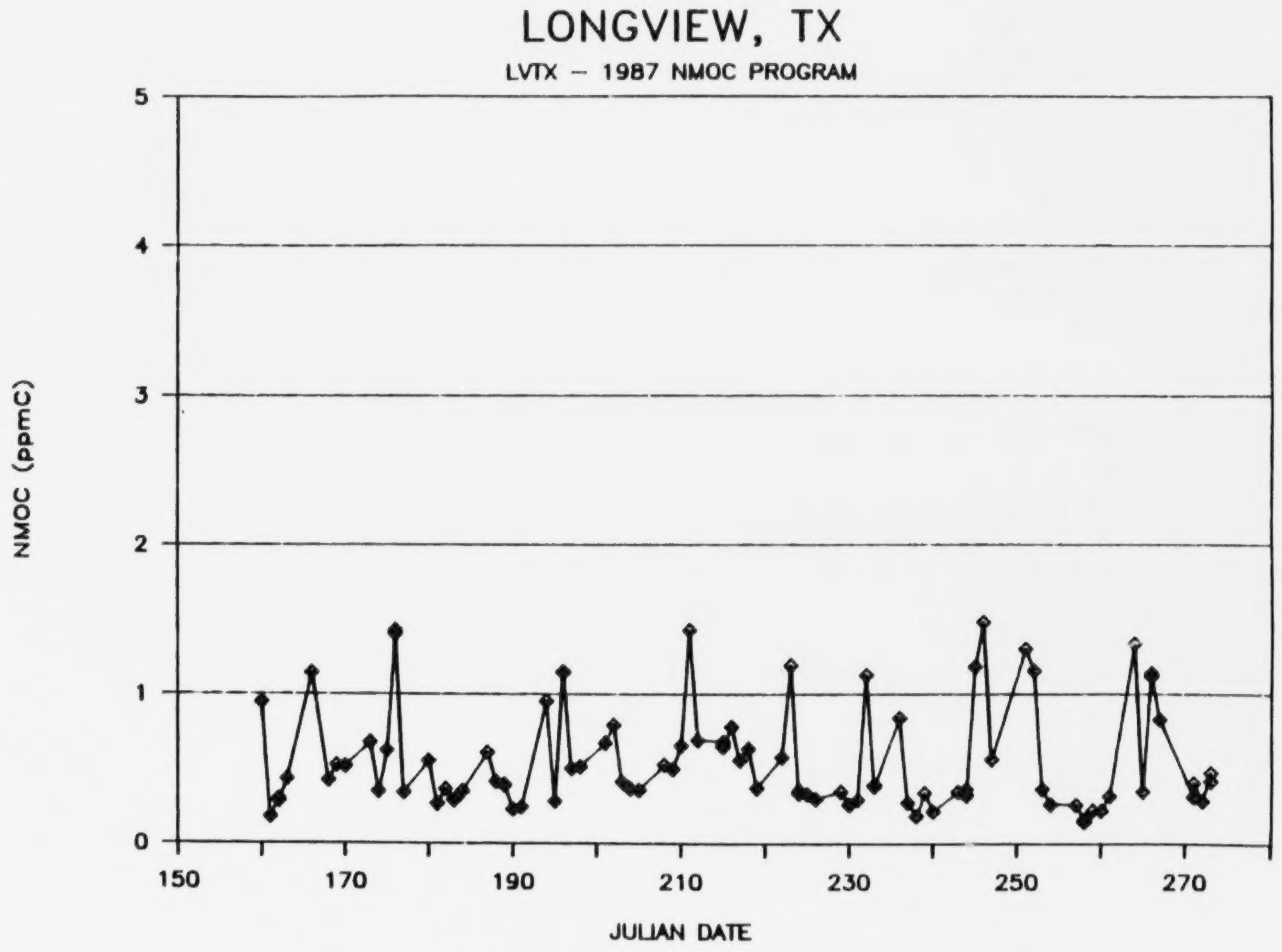

Figure 2-21. Plot of NMOC concentration for Longview, TX.

TABLE 2-24. SUMMARY OF THE 1987 NMOC DATA FOR LONGVIEW, TX (LVTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/09/87	160	T	1153	152	D	0.948		
06/10/87	161	W	1200	189	D	0.179		0.224
06/11/87	162	H	1195	96	A	0.301		
06/11/87	162	H	1195	96	A	0.284		
06/12/87	163	F	1271	148	D	0.432		
06/15/87	166	M	1266	178	A	1.144		
06/17/87	168	W	1332	53	B	0.423		
06/18/87	169	H	1366	670	A	0.526		
06/19/87	170	F	1387	645	D	0.518		
06/22/87	173	M	1409	109	C	0.676		
06/23/87	174	T	1452	652	C	0.351		
06/24/87	175	W	1466	656	D	0.625		
06/25/87	176	H	1536	501	D	1.404		
06/25/87	176	H	1537	712	D	1.429		
06/26/87	177	F	1543	692	D	0.343		
06/29/87	180	M	1601	60	D	0.552		
06/30/87	181	T	1645	709	B	0.268		
07/01/87	182	W	1665	728	D	0.366		
07/02/87	183	H	1663	696	C	0.288		
07/03/87	184	F	1719	135	D	0.351		
07/06/87	187	M	1720	104	C	0.610		
07/07/87	188	T	1766	653	A	0.416		
07/08/87	189	W	1769	309	A	0.391		
07/08/87	189	W	1769	309	C	0.397		
07/09/87	190	H	1849	147	A	0.229		
07/10/87	191	F	1842	710	B	0.244		0.174
07/13/87	194	M	1893	669	D	0.952		
07/14/87	195	T	1940	35	D	0.285		
07/15/87	196	W	1960	189	B	1.152		
07/15/87	196	W	1961	685	B	1.142		
07/16/87	197	H	1991	649	D	0.503	0.478	0.406
07/17/87	198	F	1996	112	C	0.515		
07/20/87	201	M	2105	6	C	0.673		
07/21/87	202	T	2077	79	D	0.791		
07/22/87	203	W	2185	152	C	0.415		
07/23/87	204	H	2141	695	D	0.368		
07/24/87	205	W	2173	40	D	0.360	0.248	0.235
07/27/87	208	M	2252	715	A	0.528		
07/28/87	209	T	2251	704	C	0.500		
07/29/87	210	W	2311	675	A	0.657		
07/30/87	211	H	2305	156	D	1.431		
07/31/87	212	F	2320	708	A	0.694		
08/03/87	215	M	2403	21	C	0.681		

TABLE 2-24. SUMMARY OF THE 1987 NMOC DATA FOR LONGVIEW, TX (LVTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/03/87	215	M	2404	98	D	0.648		
08/04/87	216	T	2422	727	C	0.780		
08/05/87	217	W	2440	762	A	0.558		
08/06/87	218	H	2507	763	D	0.636		
08/07/87	219	F	2524	41	C	0.374		
08/10/87	222	M	2554	500	D	0.580		
08/11/87	223	T	2611	39	B	1.194		
08/12/87	224	W	2643	194	C	0.338		
08/12/87	224	W	2643	194	D	0.360		
08/13/87	225	H	2687	649	A	0.331		
08/14/87	226	F	2728	682	C	0.300		
08/17/87	229	M	2754	307	B	0.348		
08/18/87	230	T	2810	13	C	0.262		
08/19/87	231	W	2799	15	B	0.295		
08/20/87	232	H	2836	623	D	1.130		
08/21/87	233	F	2815	138	A	0.396		
08/21/87	233	F	2815	138	C	0.385		
08/24/87	236	M	2878	761	C	0.840		
08/25/87	237	T	2945	7	C	0.274		
08/26/87	238	W	2922	309	B	0.185		
08/27/87	239	H	2995	679	A	0.339		
08/28/87	240	F	3048	191	C	0.217		
08/31/87	243	M	3043	15	D	0.348		
09/01/87	244	T	3099	644	D	0.364		
09/01/87	244	T	3098	188	D	0.323		
09/02/87	245	W	3126	790	B	1.186		
09/03/87	246	H	3105	774	B	1.483		
09/04/87	247	F	3199	689	D	0.564		
09/08/87	251	T	3233	166	C	1.304	1.269	1.261
09/09/87	252	W	3284	719	C	1.158		1.090
09/10/87	253	H	3305	96	A	0.367		
09/11/87	254	F	3367	706	D	0.265		
09/14/87	257	M	3359	681	A	0.262		
09/15/87	258	T	3376	677	C	0.162		
09/15/87	258	T	3376	677	A	0.147		
09/16/87	259	W	3423	716	D	0.225		
09/17/87	260	H	3482	197	D	0.222		
09/18/87	261	F	3533	643	D	0.321		
09/21/87	264	M	3511	53	C	1.341		
09/22/87	265	T	3544	777	A	0.351		0.287
09/23/87	266	W	3575	116	A	1.142		
09/23/87	266	W	3575	116	A	1.120		
09/24/87	267	H	3625	785	C	0.831		

TABLE 2-24. SUMMARY OF THE 1987 NMOC DATA FOR LONGVIEW, TX (LVTX)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/28/87	271	M	3704	406	A	0.318		
09/28/87	271	M	3705	678	B	0.411		
09/29/87	272	T	3711	796	B	0.288		
09/30/87	273	W	3784	186	A	0.477		
09/30/87	273	W	3785	12	D	0.422		

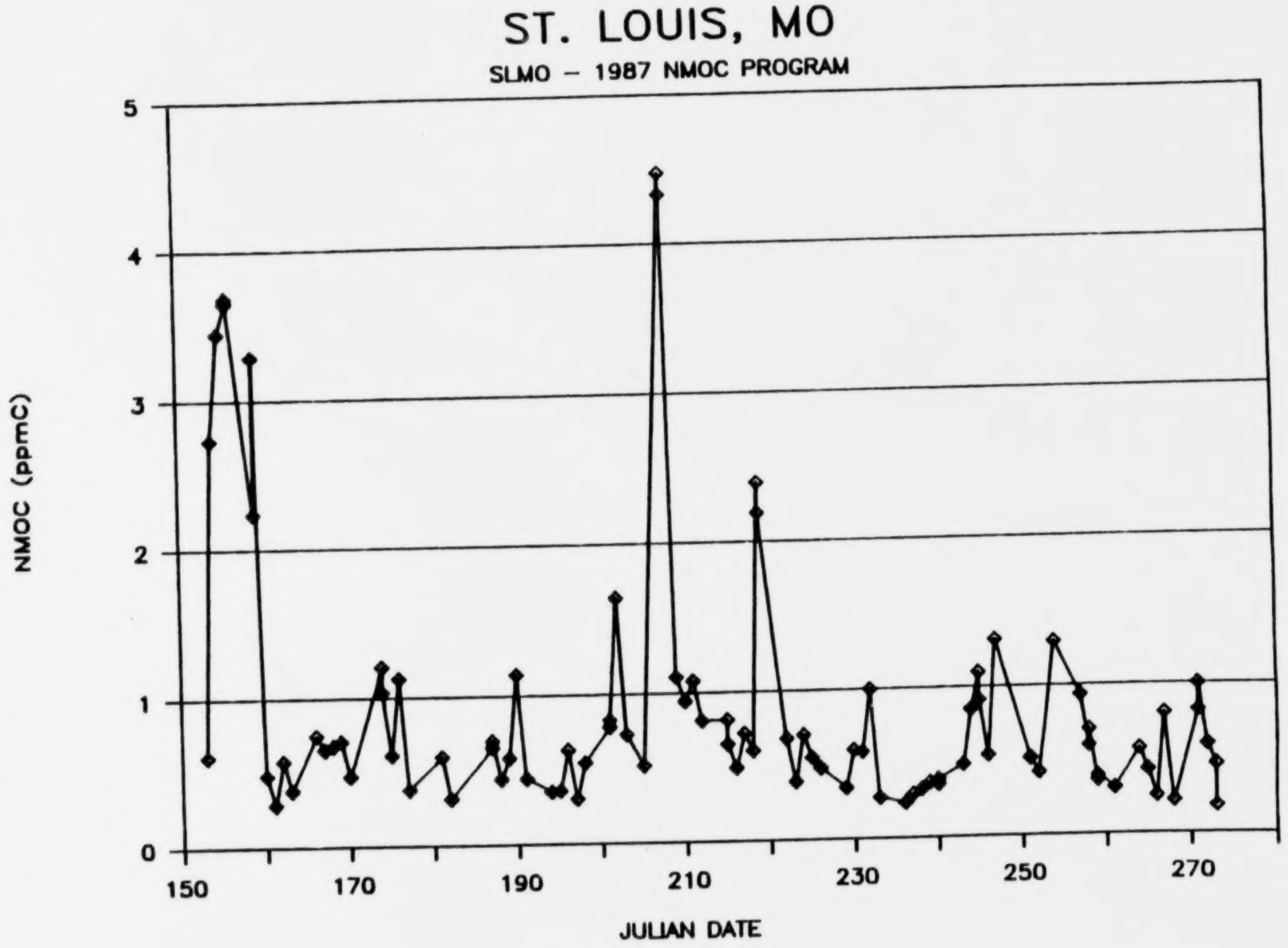

Figure 2-22. Plot of NMOC concentration for St. Louis, MO.

TABLE 2-25. SUMMARY OF THE 1987 NMOC DATA FOR ST. LOUIS, MO (SLMO)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/02/87	153	T	1119	154	D	0.611		
06/03/87	154	W	1104	98	D	2.733		
06/04/87	155	H	1117	105	C	3.448		
06/05/87	156	F	1128	4	B	3.651		5.425
06/05/87	156	F	1128	4	A	3.684		5.425
06/08/87	159	M	1145	151	A	2.235		
06/08/87	159	M	1146	407	A	3.290		
06/09/87	160	T	1166	164	B	0.483		
06/10/87	161	W	1247	63	A	0.286		
06/11/87	162	H	1249	671	C	0.578		
06/12/87	163	F	1296	78	C	0.381		
06/15/87	166	M	1352	149	C	0.751		
06/16/87	167	T	1335	160	C	0.656		
06/16/87	167	T	1335	160	D	0.656		
06/17/87	168	W	1382	93	A	0.679		
06/18/87	169	H	1383	63	C	0.712		
06/19/87	170	F	1388	100	C	0.474		
06/23/87	174	T	1465	690	C	1.204		
06/23/87	174	T	1465	690	A	1.037		
06/24/87	175	W	1532	711	D	0.613		
06/25/87	176	H	1551	649	C	1.126		
06/26/87	177	F	1548	194	B	0.378		
06/30/87	181	T	1611	74	C	0.597		
07/01/87	182	W	1679	105	B	0.315		
07/06/87	187	M	1762	660	B	0.654		
07/06/87	187	M	1763	61	C	0.699		
07/07/87	188	T	1799	652	A	0.443	0.467	0.424
07/08/87	189	W	1804	126	D	0.583		
07/09/87	190	H	1852	708	B	1.140		
07/10/87	191	F	1875	193	D	0.443		
07/13/87	194	M	1903	72	A	0.354		
07/14/87	195	T	1954	715	A	0.359		
07/15/87	196	W	1974	172	A	0.633		
07/16/87	197	H	2016	14	B	0.303		
07/17/87	198	F	2088	165	B	0.546	0.596	0.550
07/20/87	201	M	2089	672	C	0.781		
07/20/87	201	M	2089	672	C	0.829		
07/21/87	202	M	2106	133	B	1.641		
07/22/87	203	T	2174	177	C	0.731		
07/24/87	205	F	2237	162	C	0.519		
07/27/87	208	M	2227	146	A	4.475	4.156	5.142
07/27/87	208	M	2228	90	D	4.328		
07/28/87	209	T	2353	674	D	1.106		

TABLE 2-25. SUMMARY OF THE 1987 NMOC DATA FOR ST. LOUIS, MO (SLMO)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/29/87	210	W	2341	306	D	0.943		
07/30/87	211	H	2326	14	C	1.078		
07/31/87	212	F	2322	87	B	0.812		
08/03/87	215	M	2411	161	C	0.814		
08/03/87	215	M	2412	123	D	0.651		
08/04/87	216	T	2439	701	D	0.492		
08/05/87	217	W	2465	710	C	0.721	0.712	
08/06/87	218	H	2506	657	D	0.605		
08/07/87	219	F	2559	405	C	2.394		
08/07/87	219	F	2559	405	A	2.191		
08/10/87	222	M	2572	189	C	0.679		
08/11/87	223	T	2627	780	B	0.390	0.472	
08/12/87	224	W	2640	9	C	0.702		
08/13/87	225	H	2694	77	A	0.547		
08/14/87	226	F	2649	18	C	0.477		
08/17/87	229	M	2751	730	C	0.343		
08/18/87	230	T	2757	677	A	0.596		
08/19/87	231	W	2811	618	D	0.581		
08/20/87	232	H	2842	166	D	0.998		
08/21/87	233	F	2844	163	B	0.272		
08/24/87	236	M	2889	692	D	0.232		
08/25/87	237	T	2919	102	D	0.293		
08/26/87	238	W	2994	20	B	0.323		
08/27/87	239	H	3016	783	D	0.368		
08/28/87	240	F	3032	711	D	0.353		
08/28/87	240	F	3032	711	D	0.388		
08/31/87	243	M	3042	635	D	0.484		
09/01/87	244	T	3097	114	D	0.849		
09/02/87	245	W	3134	173	A	1.096		
09/02/87	245	W	3135	500	A	0.914		
09/03/87	246	H	3143	658	C	0.542	0.569	
09/04/87	247	F	3194	182	B	1.313		
09/08/87	251	T	3246	141	B	0.519		
09/08/87	251	T	3246	141	B	0.515		
09/09/87	252	W	3256	306	C	0.422		
09/11/87	254	F	3317	801	D	1.293		
09/14/87	257	M	3381	662	D	0.935		0.781
09/15/87	258	T	3377	13	C	0.596		
09/15/87	258	T	3377	13	C	0.702		
09/16/87	259	W	3495	799	D	0.361		
09/16/87	259	W	3496	188	D	0.394		
09/18/87	261	F	3474	92	B	0.310		
09/21/87	264	M	3535	9	D	0.571		

TABLE 2-25. SUMMARY OF THE 1987 NMOC DATA FOR ST. LOUIS, MO (SLMO)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/22/87	265	T	3562	710	C	0.429		
09/23/87	266	W	3624	726	D	0.254		
09/24/87	267	H	3657	303	B	0.805		
09/25/87	268	F	3732	134	B	0.220		
09/28/87	271	M	3709	636	A	0.823		
09/28/87	271	M	3709	636	D	1.001		
09/29/87	272	T	3747	784	B	0.596		
09/29/87	272	T	3748	625	A	0.595		
09/30/87	273	W	3788	674	A	0.460		
09/30/87	273	W	3789	28	B	0.182		

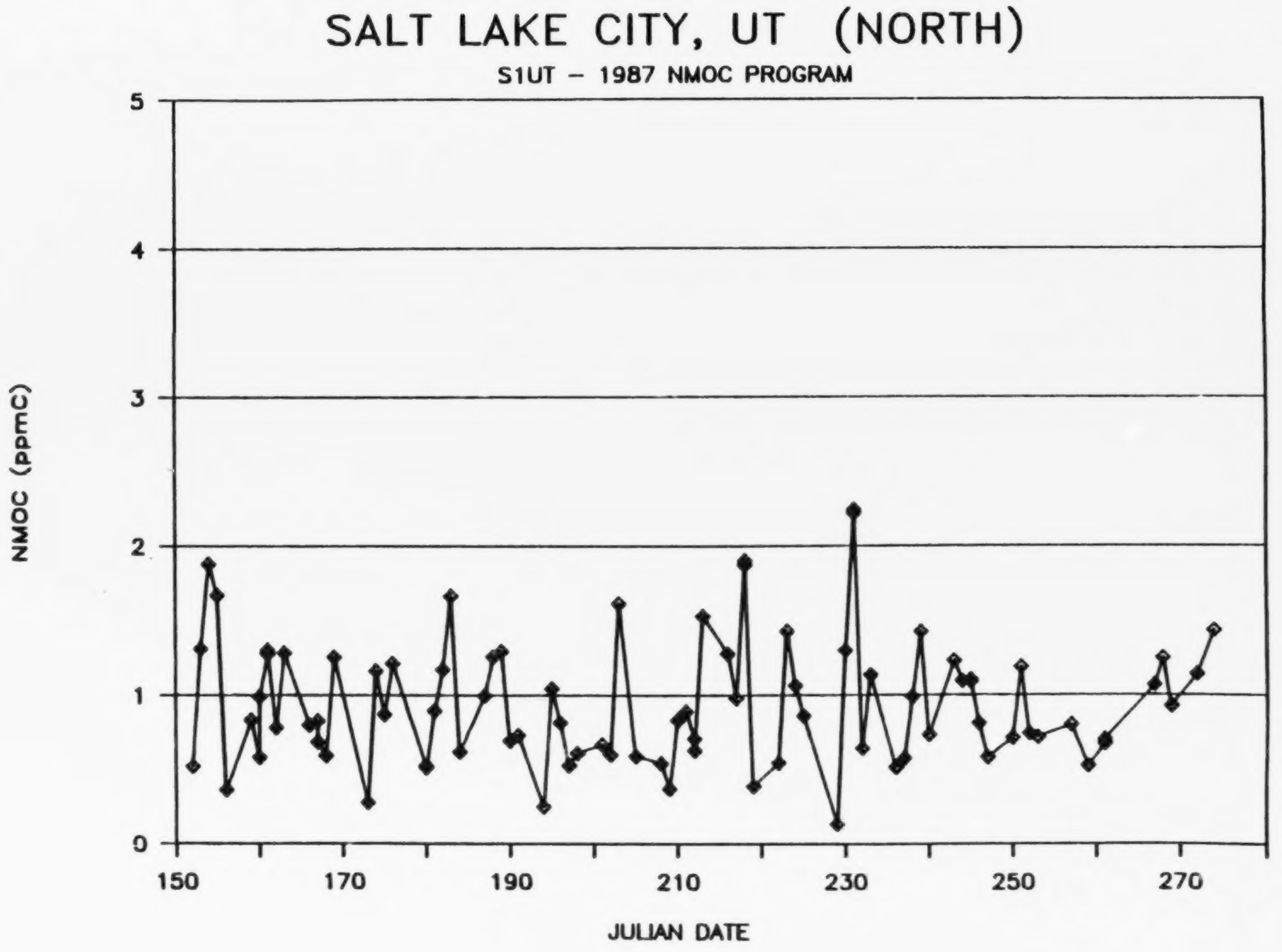

Figure 2-23. Plot of NMOC concentration for Salt Lake City, UT (North).

TABLE 2-26. SUMMARY OF THE 1987 NMOC DATA FOR SALT LAKE CITY, UT (S1UT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1003	407	B	0.521		
06/02/87	153	T	1042	102	A	1.312		
06/03/87	154	W	1036	86	C	1.879	1.765	1.842
06/04/87	155	H	1058	38	A	1.670		
06/05/87	156	F	1100	100	A	0.362		
06/08/87	159	M	1115	95	D	0.831		
06/09/87	160	T	1139	70	A	0.582		
06/09/87	160	T	1140	173	B	0.990		
06/10/87	161	W	1158	3	B	1.278		
06/10/87	161	W	1158	3	D	1.303		
06/11/87	162	H	1211	400	D	0.782		
06/12/87	163	F	1233	667	D	1.284		
06/15/87	166	M	1270	167	A	0.797		
06/16/87	167	T	1283	674	D	0.827		
06/16/87	167	T	1283	674	A	0.685		
06/17/87	168	W	1321	17	B	0.592		
06/18/87	169	H	1348	50	A	1.256		
06/22/87	173	M	1414	86	D	0.278		
06/23/87	174	T	1445	667	A	1.162		
06/24/87	175	W	1490	706	C	0.872		
06/25/87	176	H	1550	681	A	1.214		
06/29/87	180	M	1606	13	A	0.524		
06/29/87	180	M	1607	146	B	0.514		
06/30/87	181	T	1629	34	C	0.895		
07/01/87	182	W	1624	16	B	1.175		
07/02/87	183	H	1691	675	C	1.665		
07/03/87	184	F	1687	19	A	0.617	0.681	0.634
07/06/87	187	M	1743	42	C	0.996		
07/07/87	188	T	1777	64	D	1.259		
07/08/87	189	W	1836	49	B	1.295		
07/09/87	190	H	1825	673	A	0.694		
07/10/87	191	F	1855	401	C	0.729		
07/13/87	194	M	1911	114	D	0.250		
07/14/87	195	T	1920	662	A	1.044		
07/15/87	196	W	1957	28	A	0.816		
07/16/87	197	H	2038	158	B	0.527		
07/17/87	198	F	1992	719	C	0.610		0.445
07/20/87	201	M	2121	404	A	0.668		
07/21/87	202	T	2085	710	A	0.601		
07/22/87	203	W	2157	28	C	1.616		
07/24/87	205	F	2201	405	D	0.589		
07/27/87	208	M	2279	8	A	0.541		
07/28/87	209	T	2263	154	B	0.372		

TABLE 2-26. SUMMARY OF THE 1987 NMOC DATA FOR SALT LAKE CITY, UT (S1UT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/29/87	210	W	2285	141	B	0.831		
07/30/87	211	H	2294	692	D	0.891	0.889	0.786
07/31/87	212	F	2316	188	C	0.708		
07/31/87	212	F	2316	188	D	0.630		
08/01/87	213	S	2383	701	B	1.532		
08/04/87	216	T	2398	654	B	1.279		1.309
08/05/87	217	W	2472	107	A	0.979		
08/06/87	218	H	2519	670	A	1.875		
08/06/87	218	H	2520	166	A	1.902		
08/07/87	219	F	2497	22	B	0.387		
08/10/87	222	M	2542	179	C	0.545	0.580	
08/11/87	223	T	2617	106	C	1.429		
08/12/87	224	W	2588	781	C	1.065		
08/13/87	225	H	2695	103	B	0.859		
08/17/87	229	M	2749	785	B	0.132		
08/18/87	230	T	2753	109	D	1.301		
08/19/87	231	W	2813	686	A	2.217		
08/19/87	231	W	2814	721	A	2.242		
08/20/87	232	H	2802	681	B	0.644		
08/21/87	233	F	2872	644	D	1.138		
08/24/87	236	M	2876	405	A	0.513		
08/25/87	237	T	2931	401	C	0.575		
08/26/87	238	W	2960	708	B	0.989		
08/27/87	239	H	2986	146	D	1.426		
08/28/87	240	F	3055	618	C	0.733		
08/31/87	243	M	3089	39	D	1.230		
09/01/87	244	T	3118	95	C	1.095		
09/02/87	245	W	3124	35	A	1.105		
09/02/87	245	W	3125	621	A	1.092		
09/03/87	246	H	3149	672	C	0.810		
09/04/87	247	F	3185	680	C	0.582		
09/07/87	250	M	3221	130	B	0.713		
09/08/87	251	T	3211	1	C	1.190	1.273	
09/09/87	252	W	3255	630	A	0.742		
09/10/87	253	H	3286	62	A	0.715		
09/14/87	257	M	3358	774	D	0.801		0.751
09/16/87	259	W	3433	780	D	0.525		
09/18/87	261	F	3494	301	B	0.673		
09/18/87	261	F	3499	152	A	0.701		
09/24/87	267	H	3644	40	B	1.069		
09/25/87	268	F	3645	140	B	1.251		
09/26/87	269	S	3702	675	B	0.928		
09/29/87	272	T	3763	30	C	1.142		

TABLE 2-26. SUMMARY OF THE 1987 NMOC DATA FOR SALT LAKE CITY, UT (S1UT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
10/01/87	274	H	3799	664	D	1.435		

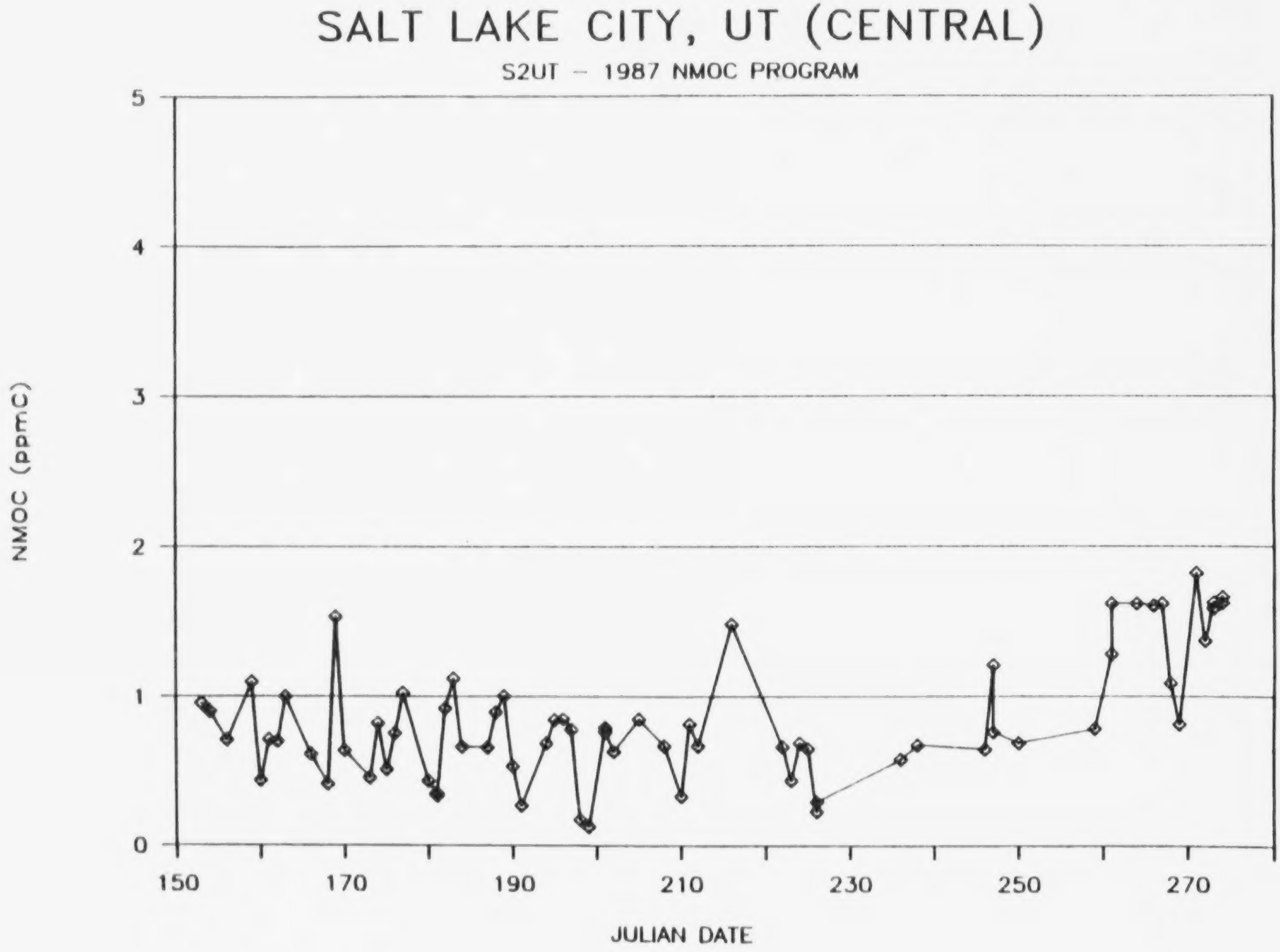

Figure 2-24. Plot of NMOC concentration for Salt Lake City, UT (Central).

TABLE 2-27. SUMMARY OF THE 1987 NMOC DATA FOR SALT LAKE CITY, UT (S2UT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/02/87	153	T	1037	404	A	0.956	1.052	1.007
06/03/87	154	W	1033	170	C	0.902		
06/03/87	154	W	1033	170	C	0.902		
06/05/87	156	F	1090	46	B	0.708		
06/08/87	159	M	1085	40	B	1.097		
06/09/87	160	T	1151	115	A	0.438		
06/10/87	161	W	1178	113	A	0.712		
06/10/87	161	W	1179	142	C	0.710		
06/11/87	162	H	1207	500	A	0.699		
06/12/87	163	F	1235	34	D	0.999		
06/15/87	166	M	1263	41	A	0.612	0.724	1.131
06/17/87	168	W	1322	6	B	0.414		
06/18/87	169	H	1340	173	C	1.535	1.386	1.544
06/19/87	170	F	1371	33	C	0.638		
06/22/87	173	M	1415	34	C	0.455		
06/23/87	174	T	1460	672	A	0.821		
06/24/87	175	W	1489	708	C	0.512		
06/25/87	176	H	1553	695	B	0.754		
06/26/87	177	F	1512	150	B	1.026		
06/29/87	180	M	1573	666	D	0.435	0.452	0.379
06/30/87	181	T	1637	401	A	0.350		
06/30/87	181	T	1638	191	C	0.338		
07/01/87	182	W	1625	703	B	0.920		
07/02/87	183	H	1699	684	B	1.122		
07/03/87	184	F	1682	701	C	0.663	0.606	0.568
07/06/87	187	M	1739	715	D	0.658		
07/07/87	188	T	1778	36	C	0.894		
07/08/87	189	W	1835	702	A	1.004		
07/09/87	190	H	1824	646	A	0.530		
07/10/87	191	F	1862	190	B	0.269		
07/13/87	194	M	1917	721	C	0.684		
07/14/87	195	T	1916	24	D	0.844		
07/15/87	196	W	1959	712	D	0.847		
07/16/87	197	H	2024	90	C	0.775		
07/17/87	198	F	1993	51	D	0.174		0.135
07/18/87	199	S	2048	50	C	0.130		
07/18/87	199	S	2058	185	C	0.127		
07/20/87	201	M	2067	723	C	0.793		
07/20/87	201	M	2116	671	C	0.762		
07/21/87	202	T	2069	657	A	0.629		
07/24/87	205	F	2203	660	D	0.849		
07/27/87	208	M	2267	147	D	0.669		
07/29/87	210	W	2287	86	C	0.332		

TABLE 2-27. SUMMARY OF THE 1987 NMOC DATA FOR SALT LAKE CITY, UT (S2UT)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/30/87	211	H	2293	647	A	0.815	0.730	0.629
07/31/87	212	F	2318	19	D	0.668		
08/04/87	216	T	2396	120	D	1.483	1.474	1.563
08/10/87	222	M	2545	50	D	0.662	0.708	
08/11/87	223	T	2613	701	A	0.437		
08/12/87	224	W	2594	782	D	0.688		
08/13/87	225	H	2682	89	B	0.648		
08/14/87	226	F	2691	645	C	0.231		
08/14/87	226	F	2666	773	C	0.294		
08/24/87	236	M	2877	771	C	0.579		
08/26/87	238	W	2954	627	C	0.674		
09/03/87	246	H	3142	121	A	0.647		
09/04/87	247	F	3213	684	C	1.210		
09/04/87	247	F	3212	101	A	0.761		
09/07/87	250	M	3216	694	C	0.688		
09/16/87	259	W	3431	700	C	0.784		
09/18/87	261	F	3490	784	A	1.283		
09/18/87	261	F	3491	675	B	1.621		
09/21/87	264	M	3529	39	C	1.621		
09/23/87	266	W	3650	652	B	1.607		
09/24/87	267	H	3632	34	C	1.622		
09/25/87	268	F	3661	774	C	1.089		
09/26/87	269	S	3690	800	D	0.814		
09/28/87	271	M	3699	400	C	1.824		
09/29/87	272	T	3762	689	C	1.373		
09/30/87	273	W	3786	193	D	1.628		
09/30/87	273	W	3787	777	D	1.589		
10/01/87	274	H	3803	637	C	1.626		
10/01/87	274	H	3804	671	C	1.667		

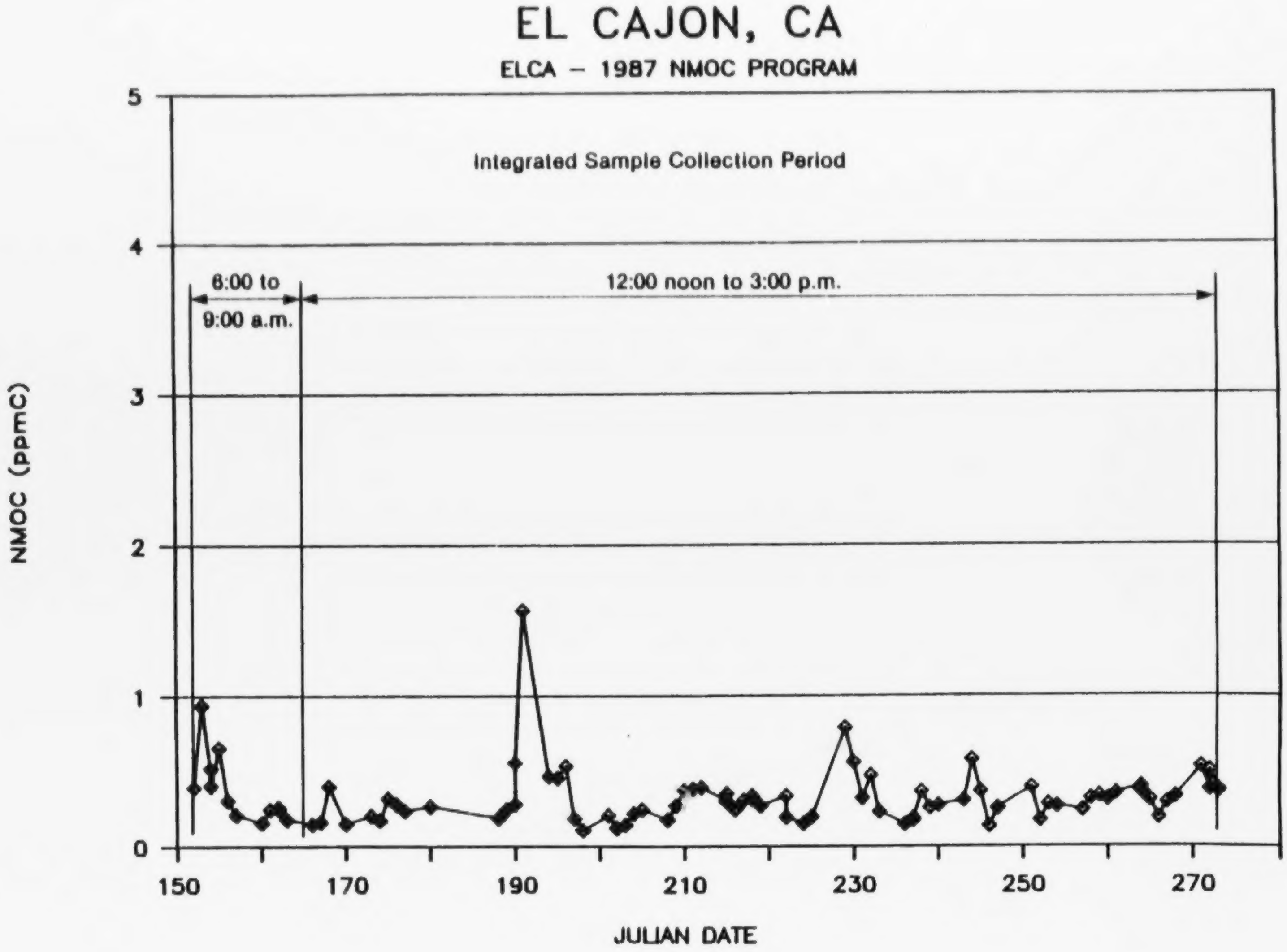

Figure 2-25. Plot of NMOC concentration for El Cajon, CA.

TABLE 2-28. SUMMARY OF THE 1987 NMOC DATA FOR EL CAJON, CA (ELCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	OAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1027	188	C	0.394		
06/02/87	153	T	1026	1	C	0.937		
06/03/87	154	W	1052	306	A	0.517		
06/03/87	154	W	1052	306	C	0.405		
06/04/87	155	H	1088	12	C	0.654		
06/05/87	156	F	1107	103	C	0.306		
06/06/87	157	S	1143	47	C	0.211		
06/09/87	160	T	1173	665	A	0.156	0.306	0.692
06/10/87	161	W	1197	169	C	0.247		
06/11/87	162	H	1239	31	C	0.247		
06/11/87	162	H	1248	15	C	0.260		
06/12/87	163	F	1244	175	C	0.181		
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06/15/87	166	M	1309	301	A	0.150		
06/16/87	167	T	1362	150	B	0.162		
06/17/87	168	W	1384	3	C	0.400	0.420	0.264
06/19/87	170	F	1435	133	A	0.153	0.281	0.176
06/22/87	173	M	1480	16	B	0.205		
06/23/87	174	T	1493	80	D	0.174	0.213	0.149
06/24/87	175	W	1555	704	C	0.319		
06/25/87	176	H	1523	662	D	0.282		
06/26/87	177	F	1574	142	C	0.236		
06/29/87	180	M	1617	724	A	0.266		
07/07/87	188	T	1803	79	D	0.187		
07/08/87	189	W	1846	707	A	0.246		
07/09/87	190	H	1837	8	A	0.282		
07/09/87	190	H	1837	8	D	0.555		
07/10/87	191	F	1906	644	C	1.567	1.814	1.944
07/13/87	194	M	1912	694	D	0.465		
07/14/87	195	T	1972	658	D	0.456		
07/15/87	196	W	2003	726	C	0.535		
07/16/87	197	H	2028	724	A	0.184		
07/17/87	198	F	2065	307	B	0.107		0.073
07/20/87	201	M	2080	659	D	0.207		
07/21/87	202	T	2148	71	C	0.121		
07/21/87	202	T	2158	98	D	0.124		
07/22/87	203	W	2167	701	A	0.144		
07/23/87	204	H	2213	655	D	0.219		
07/24/87	205	F	2235	697	C	0.243		
07/27/87	208	M	2265	687	C	0.178		0.141
07/28/87	209	T	2309	723	C	0.269		
07/29/87	210	W	2361	703	B	0.374		
07/30/87	211	H	2380	678	B	0.382		

TABLE 2-28. SUMMARY OF THE 1987 NMOC DATA FOR EL CAJON, CA (ELCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/31/87	212	F	2384	194	C	0.394		
08/03/87	215	M	2394	679	B	0.299		
08/03/87	215	M	2394	679	A	0.351		
08/04/87	216	T	2464	690	C	0.245		
08/05/87	217	W	2540	119	D	0.305		
08/06/87	218	H	2478	689	D	0.312		
08/06/87	218	H	2478	689	D	0.338		
08/07/87	219	F	2553	10	A	0.269		
08/10/87	222	M	2609	709	C	0.333		
08/10/87	222	M	2615	187	B	0.195		
08/12/87	224	W	2652	70	C	0.151		
08/13/87	225	H	2690	627	A	0.197		
08/17/87	229	M	2764	679	B	0.787		
08/18/87	230	T	2800	775	C	0.558		
08/19/87	231	W	2870	24	C	0.319		
08/20/87	232	H	2848	784	C	0.472		
08/21/87	233	F	2899	301	A	0.230		
08/24/87	236	M	2946	161	D	0.146		
08/25/87	237	T	2952	407	A	0.173		
08/25/87	237	T	2952	407	B	0.189		
08/26/87	238	W	3009	809	C	0.365		
08/27/87	239	H	3003	306	B	0.257		
08/28/87	240	F	3047	698	C	0.273		
08/31/87	243	M	3093	778	B	0.307		
09/01/87	244	T	3130	653	C	0.576		
09/02/87	245	W	3184	709	A	0.366		
09/03/87	246	H	3182	187	B	0.136		
09/04/87	247	F	3197	33	C	0.249		
09/04/87	247	F	3196	32	A	0.256		
09/08/87	251	T	3327	111	C	0.393		
09/09/87	252	W	3297	676	B	0.173		
09/10/87	253	H	3316	53	C	0.282		
09/11/87	254	F	3349	679	A	0.267		
09/11/87	254	F	3349	679	A	0.266		
09/14/87	257	M	3383	798	A	0.242		
09/15/87	258	T	3418	89	C	0.320		
09/16/87	259	W	3473	712	C	0.336		
09/17/87	260	H	3458	100	A	0.313		0.242
09/18/87	261	F	3522	801	C	0.354		
09/21/87	264	M	3564	781	A	0.400		
09/21/87	264	M	3565	62	C	0.365		
09/22/87	265	T	3581	659	A	0.309		
09/23/87	266	W	3633	653	C	0.192		

TABLE 2-28. SUMMARY OF THE 1987 NMOC DATA FOR EL CAJON, CA (ELCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/24/87	267	H	3658	662	A	0.291		
09/25/87	268	F	3685	702	B	0.331		
09/28/87	271	M	3726	708	C	0.532		0.361
09/29/87	272	T	3782	70	A	0.378		
09/29/87	272	T	3783	779	D	0.507		
09/30/87	273	W	3796	143	C	0.378		
09/30/87	273	W	3797	79	C	0.367		

*Sampling period through Julian Date 163 occurred from 6:00 AM to 9:00 AM.
Sampling period beginning Julian Date 166 occurred from 12:00 Noon to 3:00 PM.

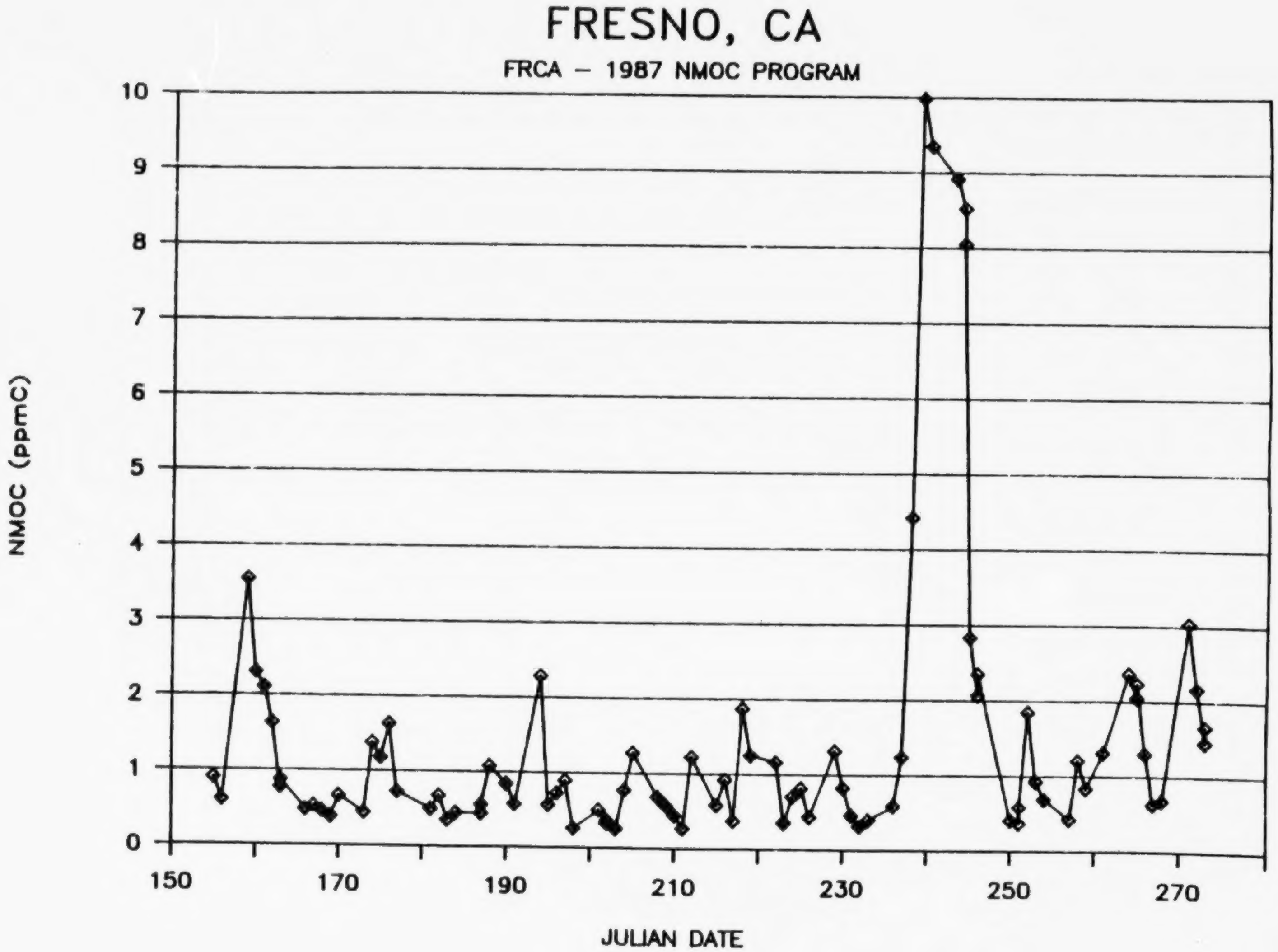

Figure 2-26. Plot of NMOC concentration for Fresno, CA (Expanded).

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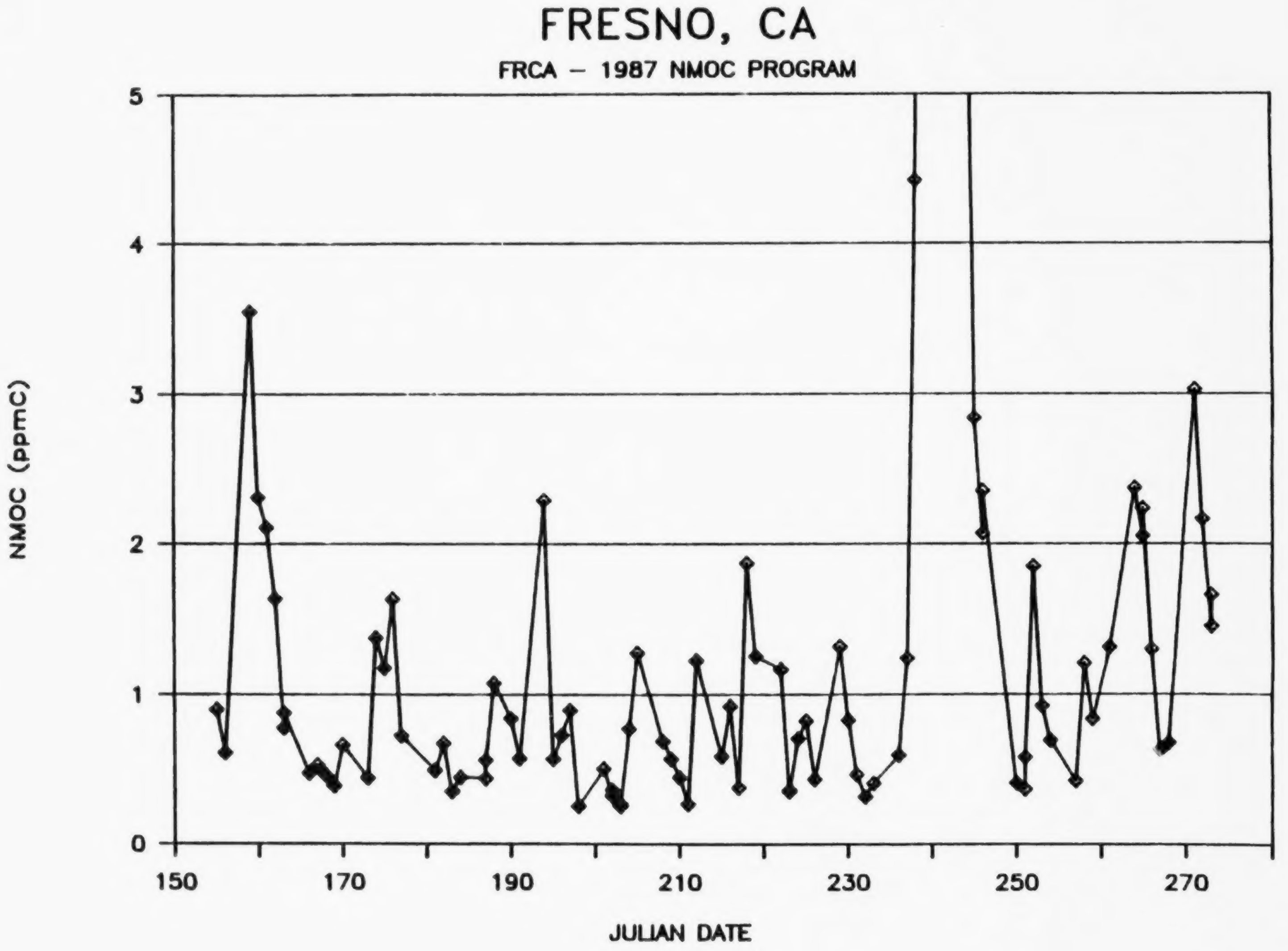

Figure 2-27. Plot of NMOC concentration for Fresno, CA.

TABLE 2-29. SUMMARY OF THE 1987 NMOC DATA FOR FRESNO, CA (FRCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/04/87	155	H	1063	657	C	0.898		
06/05/87	156	F	1096	679	A	0.609		
06/08/87	159	M	1108	674	D	3.547	3.036	3.251
06/09/87	160	T	1135	647	B	2.309	2.100	2.122
06/10/87	161	W	1171	404	D	2.106		
06/11/87	162	H	1246	20	C	1.635		
06/12/87	163	F	1232	157	D	0.775		
06/12/87	163	F	1237	36	C	0.877		
06/15/87	166	M	1300	95	D	0.475		
06/16/87	167	T	1308	661	D	0.529		
06/17/87	168	W	1368	4	A	0.462		
06/18/87	169	H	1393	113	D	0.390		
06/19/87	170	F	1413	169	C	0.664		
06/22/87	173	M	1444	188	B	0.445		
06/23/87	174	T	1488	696	D	1.376		
06/24/87	175	W	1496	153	C	1.177		
06/25/87	176	H	1547	707	C	1.632		1.380
06/26/87	177	F	1520	4	C	0.724	0.750	0.545
06/30/87	181	T	1631	166	A	0.495		
07/01/87	182	W	1674	98	D	0.673		
07/02/87	183	H	1700	137	B	0.355		
07/03/87	184	F	1692	20	C	0.450		
07/06/87	187	M	1733	35	B	0.442		
07/06/87	187	M	1734	658	C	0.561		
07/07/87	188	T	1772	149	D	1.076	0.930	0.834
07/09/87	190	H	1877	192	B	0.840		
07/10/87	191	F	1890	16	C	0.572		
07/13/87	194	M	1915	15	C	2.289		
07/14/87	195	T	1936	111	A	0.570	0.627	0.411
07/15/87	196	W	1979	677	B	0.727		
07/16/87	197	H	1997	139	D	0.892		
07/17/87	198	F	2018	113	C	0.257		
07/20/87	201	M	2081	151	D	0.507		
07/21/87	202	T	2087	13	A	0.326		
07/21/87	202	T	2087	13	D	0.366		
07/22/87	203	W	2142	692	D	0.257		
07/22/87	203	W	2149	721	D	0.269		
07/23/87	204	H	2164	658	C	0.773		
07/24/87	205	F	2166	74	A	1.274		1.035
07/27/87	208	M	2236	119	C	0.688		
07/28/87	209	T	2268	689	B	0.571		
07/29/87	210	W	2298	649	D	0.446		
07/30/87	211	H	2334	725	B	0.271		

TABLE 2-29. SUMMARY OF THE 1987 NMOC DATA FOR FRESNO, CA (FRCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/31/87	212	F	2317	404	B	1.225	1.292	1.372
08/03/87	215	M	2416	180	D	0.586		
08/04/87	216	T	2455	706	C	0.921		
08/05/87	217	W	2466	645	B	0.379		
08/06/87	218	H	2537	100	B	1.870		
08/07/87	219	F	2531	716	D	1.254		
08/10/87	222	M	2577	173	B	1.165		
08/11/87	223	T	2597	12	B	0.354		
08/11/87	223	T	2598	686	B	0.363		
08/12/87	224	W	2668	787	D	0.706		
08/13/87	225	H	2696	783	B	0.822		
08/14/87	226	F	2671	71	A	0.436		
08/17/87	229	M	2741	795	C	1.317		
08/18/87	230	T	2768	717	D	0.830		
08/19/87	231	W	2826	689	C	0.467		
08/20/87	232	H	2829	678	C	0.318		
08/21/87	233	F	2867	137	B	0.407		
08/24/87	236	M	2875	718	B	0.595	0.580	
08/25/87	237	T	2917	70	C	1.242		
08/26/87	238	W	2956	91	B	4.420		
08/27/87	239	H	3001	181	B	9.984		
08/28/87	240	F	3033	717	A	9.350		10.118
08/31/87	243	M	3054	687	A	8.917		8.893
09/01/87	244	T	3074	696	C	8.520		
09/01/87	244	T	3074	696	B	8.050		
09/02/87	245	W	3108	78	C	2.839	2.517	2.946
09/03/87	246	H	3146	718	A	2.069		2.073
09/03/87	246	H	3147	765	D	2.355		2.018
09/07/87	250	M	3231	70	D	0.410	0.472	
09/08/87	251	T	3243	60	A	0.368		
09/08/87	251	T	3238	61	D	0.582		
09/09/87	252	W	3272	666	C	1.850		
09/10/87	253	H	3295	634	A	0.925		0.684
09/11/87	254	F	3335	41	D	0.693		
09/14/87	257	M	3356	84	D	0.425		
09/15/87	258	T	3398	404	D	1.207		
09/16/87	259	W	3478	189	D	0.836		
09/18/87	261	F	3454	627	C	1.316		
09/21/87	264	M	3520	91	A	2.373		2.075
09/22/87	265	T	3566	718	A	2.052		
09/22/87	265	T	3567	12	D	2.237		
09/23/87	266	W	3631	47	B	1.301		
09/24/87	267	H	3655	501	A	0.632		

TABLE 2-29. SUMMARY OF THE 1987 NMOC DATA FOR FRESNO, CA (FRCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/25/87	268	F	3654	153	C	0.680		
09/28/87	271	M	3684	126	D	3.032		
09/29/87	272	T	3713	801	C	2.167		
09/30/87	273	W	3768	74	A	1.455		
09/30/87	273	W	3769	21	B	1.662		

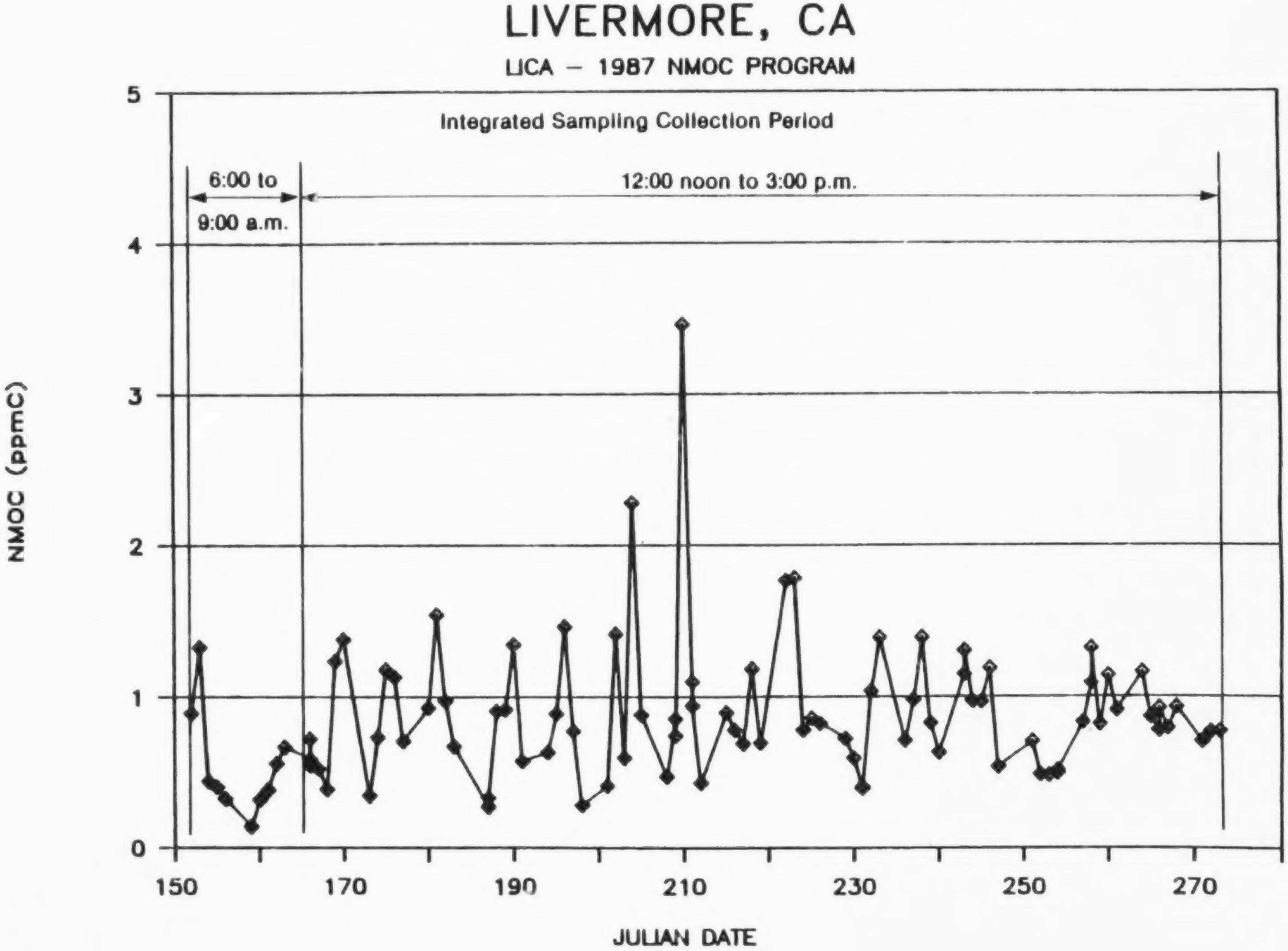

Figure 2-28. Plot of NMOC concentration for Livermore, CA.

TABLE 2-30. SUMMARY OF THE 1987 NMOC DATA FOR LIVERMORE, CA (LICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1010	307	D	0.893		
06/02/87	153	T	1034	142	B	1.330	1.029	0.940
06/03/87	154	W	1041	192	B	0.443		
06/04/87	155	H	1099	55	B	0.404		
06/05/87	156	F	1097	84	C	0.326		
06/08/87	159	M	1132	177	D	0.140		
06/08/87	159	M	1132	177	B	0.143		
06/09/87	160	T	1167	648	D	0.320	0.388	0.340
06/10/87	161	W	1196	99	B	0.384		
06/10/87	161	W	1196	99	D	0.387		
06/11/87	162	H	1250	116	B	0.560		
06/12/87	163	F	1230	134	A	0.669		
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06/15/87	166	M	1281	673	A	0.590		
06/15/87	166	M	1281	673	C	0.721		
06/15/87	166	M	1282	655	B	0.547		
06/16/87	167	T	1314	123	D	0.525		
06/17/87	168	W	1337	657	A	0.390		
06/18/87	169	H	1386	15	A	1.235		
06/19/87	170	F	1419	664	A	1.379		
06/22/87	173	M	1461	651	B	0.347		
06/23/87	174	T	1470	691	D	0.734	0.715	0.624
06/24/87	175	W	1505	698	B	1.181		
06/25/87	176	H	1541	70	C	1.133		
06/26/87	177	F	1582	680	A	0.709		
06/29/87	180	M	1589	182	C	0.929		
06/30/87	181	T	1639	109	C	1.542		
07/01/87	182	W	1661	185	A	0.975		
07/02/87	183	H	1703	3	D	0.673		
07/06/87	187	M	1736	68	B	0.272	0.354	0.235
07/06/87	187	M	1737	662	C	0.333		
07/07/87	188	T	1776	500	A	0.907		
07/08/87	189	W	1797	158	B	0.919		
07/09/87	190	H	1878	301	D	1.346		
07/10/87	191	F	1868	54	D	0.575		
07/13/87	194	M	1922	706	B	0.634		
07/14/87	195	T	1955	11	A	0.890		
07/15/87	196	W	1968	178	C	1.464		1.348
07/16/87	197	H	2045	407	D	0.774	0.777	0.819
07/17/87	198	F	2050	147	B	0.284		
07/20/87	201	M	2072	717	A	0.412		
07/21/87	202	T	2111	82	D	1.415		
07/22/87	203	W	2138	103	B	0.599		

TABLE 2-30. SUMMARY OF THE 1987 NMOC DATA FOR LIVERMORE, CA (LICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/23/87	204	H	2165	35	D	2.280		2.031
07/24/87	205	F	2180	706	D	0.881		
07/27/87	208	M	2244	36	B	0.474		
07/28/87	209	T	2260	172	C	0.856		
07/28/87	209	T	2260	172	A	0.745		
07/29/87	210	W	2314	652	C	3.462		
07/30/87	211	H	2390	71	C	1.100		
07/30/87	211	H	2391	170	D	0.942		
07/31/87	212	F	2333	175	B	0.432		
08/03/87	215	M	2445	718	C	0.897		1.149
08/04/87	216	T	2436	700	B	0.782		
08/05/87	217	W	2453	18	D	0.691		
08/06/87	218	H	2499	129	C	1.186		
08/07/87	219	F	2514	730	D	0.698		
08/10/87	222	M	2563	7	F	1.767		
08/11/87	223	T	2616	16	C	1.784		
08/12/87	224	W	2626	306	D	0.781	0.670	
08/13/87	225	H	2659	671	C	0.860		
08/14/87	226	F	2705	120	B	0.826	0.781	
08/17/87	229	M	2735	789	A	0.726		
08/18/87	230	T	2767	30	C	0.595		
08/19/87	231	W	2858	710	A	0.395		
08/19/87	231	W	2859	34	A	0.409		
08/20/87	232	H	2828	404	C	1.040		
08/21/87	233	F	2850	684	D	1.392		
08/24/87	236	M	2879	501	D	0.713		
08/25/87	237	T	2923	647	D	0.979		
08/26/87	238	W	2967	74	C	1.392		
08/27/87	239	H	2990	108	C	0.829		
08/28/87	240	F	3036	661	C	0.636		
08/31/87	243	M	3038	80	A	1.153		
08/31/87	243	M	3038	80	A	1.306		
09/01/87	244	T	3053	669	C	0.972	0.897	
09/02/87	245	W	3170	722	D	0.969		
09/03/87	246	H	3189	797	D	1.192		
09/04/87	247	F	3188	122	B	0.539		
09/08/87	251	T	3225	700	D	0.708		
09/09/87	252	W	3254	98	A	0.490		0.569
09/10/87	253	H	3291	191	C	0.484		
09/11/87	254	F	3357	21	B	0.498		
09/11/87	254	F	3358	173	D	0.518		
09/14/87	257	M	3369	190	C	0.834		
09/15/87	258	T	3402	407	A	1.094		

TABLE 2-30. SUMMARY OF THE 1987 NMOC DATA FOR LIVERMORE, CA (LICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/15/87	258	T	3402	407	C	1.323		
09/16/87	259	W	3405	36	C	0.820		
09/17/87	260	H	3488	131	D	1.143		
09/18/87	261	F	3503	77	A	0.912		
09/21/87	264	M	3521	786	D	1.166		
09/22/87	265	T	3555	719	B	0.869		
09/23/87	266	W	3601	87	B	0.779		
09/23/87	266	W	3602	685	B	0.926		
09/24/87	267	H	3647	724	D	0.795		
09/25/87	268	F	3675	37	D	0.933		0.559
09/28/87	271	M	3693	782	A	0.708		
09/29/87	272	T	3723	699	D	0.773		0.545
09/30/87	273	W	3755	641	C	0.776		

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*Sampling through Julian Date 163 occurred from 6:00 AM to 9:00 AM.
Sampling beginning Julian Date 166 occurred from 12:00 Noon to 3:00 PM.

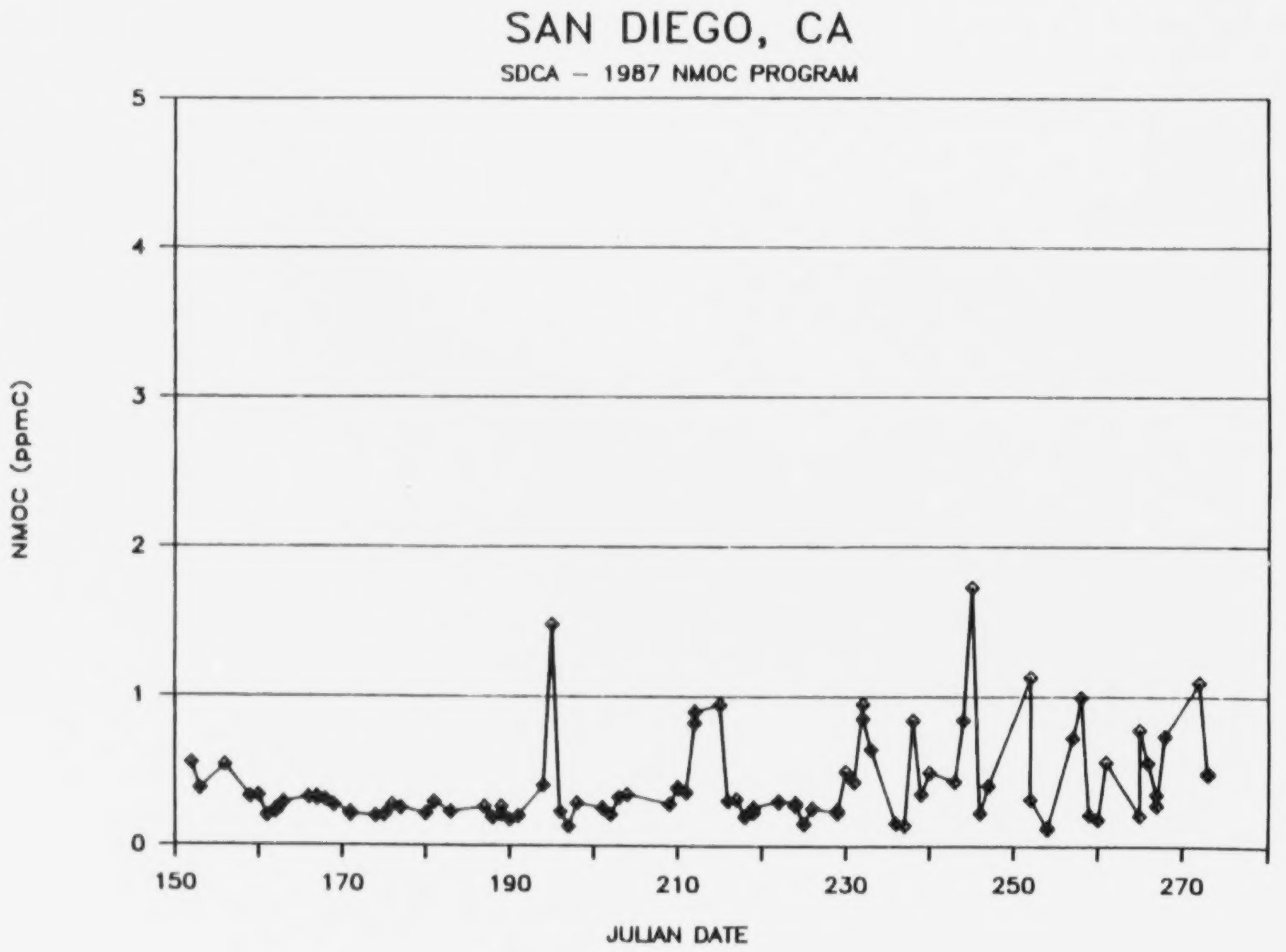

Figure 2-29. Plot of NMOC concentration for San Diego, CA.

TABLE 2-31. SUMMARY OF THE 1987 NMOC DATA FOR SAN DIEGO, CA (SDCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1025	109	D	0.550		
06/02/87	153	T	1020	135	A	0.378		
06/05/87	156	F	1076	194	A	0.536	0.525	0.599
06/08/87	159	M	1141	13	D	0.327		
06/09/87	160	T	1182	653	D	0.335		
06/10/87	161	W	1198	657	D	0.200		
06/11/87	162	H	1218	166	A	0.240		
06/11/87	162	H	1218	166	A	0.224		
06/12/87	163	F	1245	138	C	0.288		
06/15/87	166	M	1310	139	B	0.323		
06/16/87	167	T	1328	403	A	0.313		
06/16/87	167	T	1329	145	C	0.325		
06/17/87	168	W	1363	680	D	0.310		
06/18/87	169	H	1373	105	B	0.273		
06/18/87	169	H	1373	105	B	0.273		
06/20/87	171	S	1434	140	C	0.223		
06/20/87	171	S	1434	140	D	0.208		
06/23/87	174	T	1481	122	C	0.200		
06/24/87	175	W	1491	138	B	0.206	0.185	0.182
06/25/87	176	H	1562	307	B	0.273		
06/26/87	177	F	1522	290	C	0.254		
06/29/87	180	M	1576	403	D	0.217		
06/30/87	181	T	1616	163	A	0.293		
07/02/87	183	H	1694	306	A	0.227		
07/06/87	187	M	1760	22	D	0.260		
07/07/87	188	T	1757	712	A	0.189		
07/08/87	189	W	1822	71	C	0.209		
07/08/87	189	W	1823	689	C	0.265		
07/09/87	190	H	1845	120	B	0.176		
07/10/87	191	F	1841	671	D	0.200	0.235	0.160
07/13/87	194	M	1905	166	B	0.407		
07/14/87	195	T	1910	105	D	1.480		
07/15/87	196	W	1978	713	B	0.231		
07/16/87	197	H	1998	309	C	0.129		
07/17/87	198	F	2035	704	C	0.286		
07/20/87	201	M	2073	141	B	0.256		
07/21/87	202	T	2082	93	D	0.210		
07/22/87	203	W	2159	661	B	0.327		
07/23/87	204	H	2168	43	B	0.345		
07/28/87	209	T	2266	51	D	0.281		
07/29/87	210	W	2288	664	A	0.386		
07/29/87	210	W	2288	664	B	0.395		
07/30/87	211	H	2360	4	B	0.359		

TABLE 2-31. SUMMARY OF THE 1987 NMOC DATA FOR SAN DIEGO, CA (SDCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/31/87	212	F	2356	42	C	0.823		
07/31/87	212	F	2357	179	C	0.899		
08/03/87	215	M	2386	47	D	0.944		
08/04/87	216	T	2406	53	A	0.302		
08/05/87	217	W	2459	48	C	0.315		
08/06/87	218	H	2500	11	D	0.196		
08/07/87	219	F	2477	651	A	0.225		
08/07/87	219	F	2477	651	A	0.259		
08/10/87	222	M	2547	48	C	0.301		
08/10/87	222	M	2547	48	B	0.294		
08/12/87	224	W	2622	149	A	0.288		
08/12/87	224	W	2622	149	D	0.271		
08/13/87	225	H	2681	116	B	0.150		
08/14/87	226	F	2675	160	D	0.254		
08/17/87	229	M	2712	84	D	0.223		
08/17/87	229	M	2712	8	C	0.242		
08/18/87	230	T	2765	651	C	0.498		
08/19/87	231	W	2804	6	C	0.430		
08/20/87	232	H	2856	767	B	0.949		
08/20/87	232	H	2857	716	B	0.852		
08/21/87	233	F	2831	126	A	0.646		
08/24/87	236	M	2893	171	A	0.154		
08/25/87	237	T	2944	75	C	0.141		
08/26/87	238	W	2969	194	B	0.840		
08/27/87	239	H	3013	715	D	0.347		
08/28/87	240	F	3019	21	A	0.492		
08/31/87	243	M	3058	714	A	0.432		0.391
09/01/87	244	T	3075	44	C	0.844		
09/02/87	245	W	3107	46	D	1.728		
09/03/87	246	H	3159	131	C	0.224		
09/04/87	247	F	3195	197	B	0.404		
09/09/87	252	W	3292	14	D	1.130		
09/10/87	253	H	3296	30	A	0.315		
09/11/87	254	F	3325	160	B	0.118		
09/11/87	254	F	3326	175	D	0.127		
09/14/87	257	M	3352	730	A	0.725		
09/15/87	258	T	3387	10	A	0.995		
09/16/87	259	W	3419	48	B	0.213		
09/17/87	260	H	3469	145	C	0.182		
09/18/87	261	F	3459	70	D	0.561		
09/21/87	264	T	3513	44	B	0.208		0.191
09/22/87	265	T	3550	181	D	0.779		
09/23/87	266	W	3589	43	A	0.558		

TABLE 2-31. SUMMARY OF THE 1987 NMOC DATA FOR SAN DIEGO, CA (SDCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/24/87	267	H	3664	772	B	0.348		
09/24/87	267	H	3665	680	C	0.276		
09/25/87	268	F	3653	109	C	0.736		
09/29/87	272	T	3731	624	B	1.096		0.956
09/30/87	273	W	3774	644	D	0.498		
09/30/87	273	W	3775	6	B	0.483		

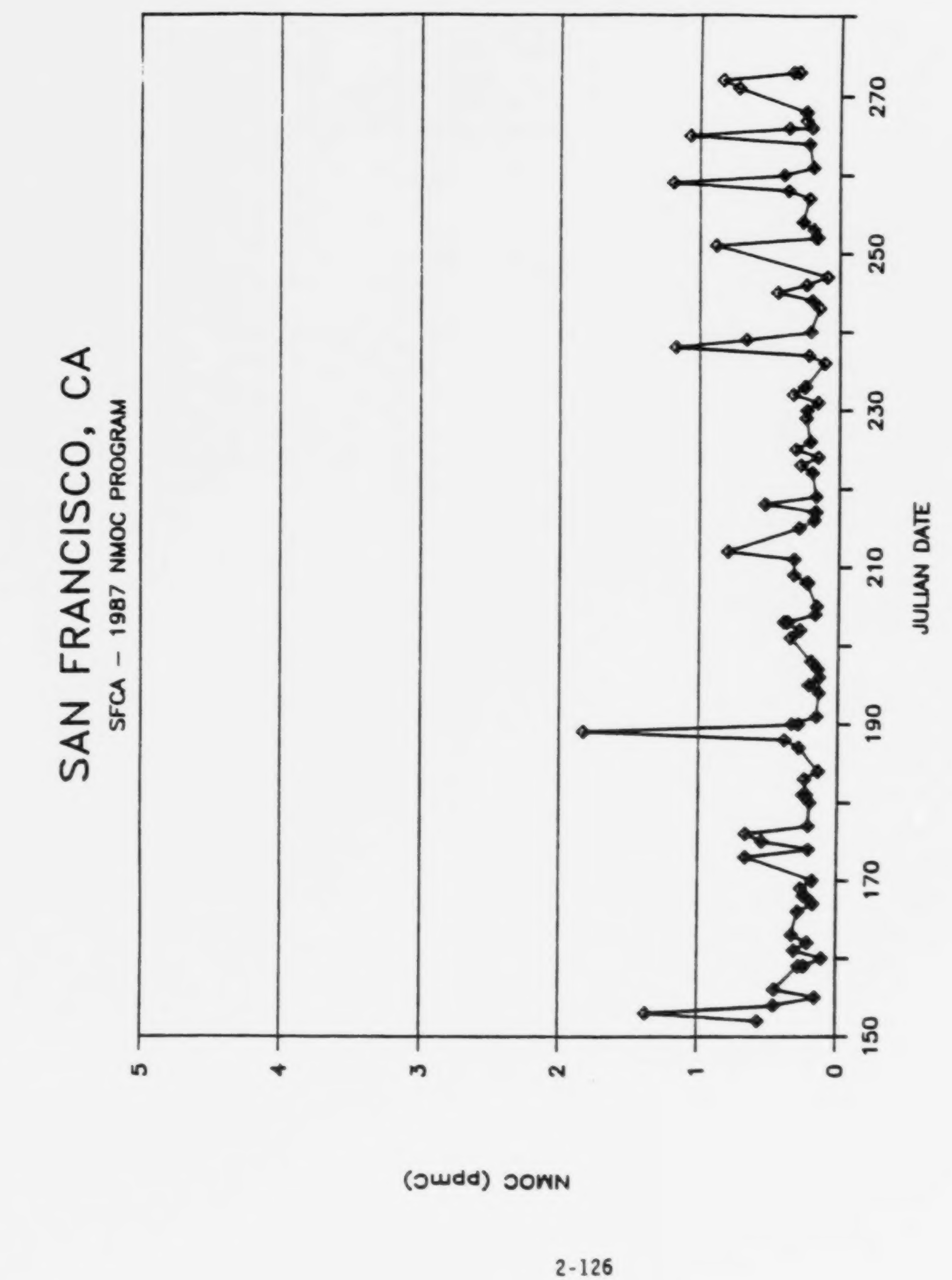

Figure 2-30. Plot of NMOC concentration for San Francisco, CA.

TABLE 2-32. SUMMARY OF THE 1987 NMOC DATA FOR SAN FRANCISCO, CA (SFCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1022	148	A	0.565		
06/02/87	153	T	1035	99	D	1.370	1.438	1.550
06/03/87	154	W	1071	87	D	0.450		
06/04/87	155	H	1094	64	C	0.151		
06/05/87	156	F	1127	308	M	0.444		
06/08/87	159	M	1129	403	D	0.269		
06/08/87	159	M	1129	403	B	0.231		
06/09/87	160	T	1160	60	A	0.105		0.129
06/10/87	161	W	1209	165	C	0.303		
06/11/87	162	H	1229	48	C	0.207	0.210	0.173
06/12/87	163	F	1216	308	D	0.319	0.299	0.345
06/15/87	166	M	1289	90	D	0.279	0.328	
06/16/87	167	T	1305	405	D	0.168	0.188	
06/17/87	168	W	1341	165	A	0.226		
06/17/87	168	W	1342	49	D	0.235	0.265	0.195
06/18/87	169	H	1397	141	C	0.259		
06/19/87	170	F	1379	158	D	0.175	0.236	0.165
06/22/87	173	M	1436	148	C	0.656	0.565	0.574
06/23/87	174	T	1439	111	A	0.206		
06/24/87	175	W	1502	697	D	0.539		
06/25/87	176	H	1517	68	C	0.657		
06/26/87	177	F	1577	154	D	0.209		
06/29/87	180	M	1600	156	C	0.196		
06/30/87	181	T	1633	82	D	0.248		
07/01/87	182	W	1667	157	A	0.222		
07/02/87	183	H	1690	73	C	0.236		
07/03/87	184	F	1765	31	C	0.139		
07/06/87	187	M	1742	729	D	0.279		0.231
07/07/87	188	T	1775	75	C	0.382		
07/08/87	189	W	1819	709	A	1.825		
07/09/87	190	H	1850	676	C	0.282		
07/09/87	190	F	1851	9	D	0.331		
07/10/87	191	F	1892	150	A	0.151		
07/13/87	194	M	1927	645	B	0.135		
07/14/87	195	T	1933	691	D	0.205		
07/14/87	195	T	1933	691	C	0.208		
07/15/87	196	W	1945	68	D	0.132	0.191	0.136
07/16/87	197	H	2022	179	B	0.144		
07/17/87	198	F	2008	119	A	0.195		
07/20/87	201	M	2075	190	A	0.342		
07/21/87	202	T	2096	106	C	0.276		
07/22/87	203	W	2129	699	D	0.392		
07/22/87	203	W	2129	699	A	0.365		

TABLE 2-32. SUMMARY OF THE 1987 NMOC DATA FOR SAN FRANCISCO, CA (SFCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/23/87	204	H	2182	92	A	0.167	0.125	0.125
07/24/87	205	F	2183	115	D	0.156		
07/27/87	208	M	2230	49	A	0.234		
07/27/87	208	M	2231	183	D	0.223		
07/28/87	209	T	2273	717	B	0.323		
07/30/87	211	H	2346	661	D	0.324		
07/31/87	212	F	2388	105	A	0.794		
08/03/87	215	M	2397	60	C	0.286	0.328	0.261
08/04/87	216	T	2441	410	C	0.180		
08/05/87	217	W	2457	162	D	0.177		
08/05/87	217	W	2457	162	C	0.167		
08/06/87	218	H	2523	192	A	0.531		
08/07/87	219	F	2550	93	C	0.166		
08/10/87	222	M	2562	647	B	0.195	0.215	
08/11/87	223	T	2603	407	D	0.276		
08/12/87	224	W	2646	620	A	0.152	0.273	
08/13/87	225	H	2653	788	D	0.311		
08/14/87	226	F	2704	31	A	0.207	0.246	
08/17/87	229	M	2742	762	A	0.240		
08/18/87	230	T	2781	687	D	0.233		
08/19/87	231	W	2787	636	B	0.154		
08/20/87	232	H	2860	170	D	0.331		
08/21/87	233	F	2861	32	A	0.252		
08/21/87	233	F	2862	158	C	0.243		
08/24/87	236	M	2894	98	A	0.108		
08/25/87	237	T	2924	68	B	0.222		
08/26/87	238	W	2970	638	C	1.172		
08/27/87	239	H	2991	808	D	0.667		
08/28/87	240	F	3037	633	A	0.208		
08/31/87	243	M	3063	100	B	0.144		
09/01/87	244	T	3080	301	D	0.199		
09/02/87	245	W	3106	113	D	0.443		
09/03/87	246	H	3160	407	D	0.238		
09/04/87	247	F	3180	713	A	0.091		
09/08/87	251	T	3235	136	D	0.882		
09/09/87	252	W	3252	86	B	0.174		
09/09/87	252	W	3251	788	B	0.160		0.162
09/10/87	253	H	3309	500	B	0.189		
09/11/87	254	F	3314	410	C	0.266		
09/11/87	254	F	3314	410	A	0.265		
09/14/87	257	M	3361	52	C	0.219		
09/15/87	258	T	3404	694	B	0.372		0.333
09/16/87	259	W	3414	121	C	1.191		

TABLE 2-32. SUMMARY OF THE 1987 NMOC DATA FOR SAN FRANCISCO, CA (SFCA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/17/87	260	H	3448	68	D	0.403		
09/18/87	261	F	3460	646	C	0.190		
09/21/87	264	M	3554	682	B	0.221		
09/22/87	265	T	3546	3	B	1.069		
09/23/87	266	W	3576	120	C	0.365		
09/23/87	266	W	3576	120	A	0.202		
09/24/87	267	H	3660	775	D	0.241		
09/25/87	268	F	3672	778	C	0.242		
09/25/87	268	F	3673	173	D	0.245		0.191
09/28/87	271	M	3695	64	C	0.726		
09/29/87	272	T	3714	790	B	0.837		0.794
09/30/87	273	W	3778	764	C	0.339		
09/30/87	273	W	3779	82	B	0.294		

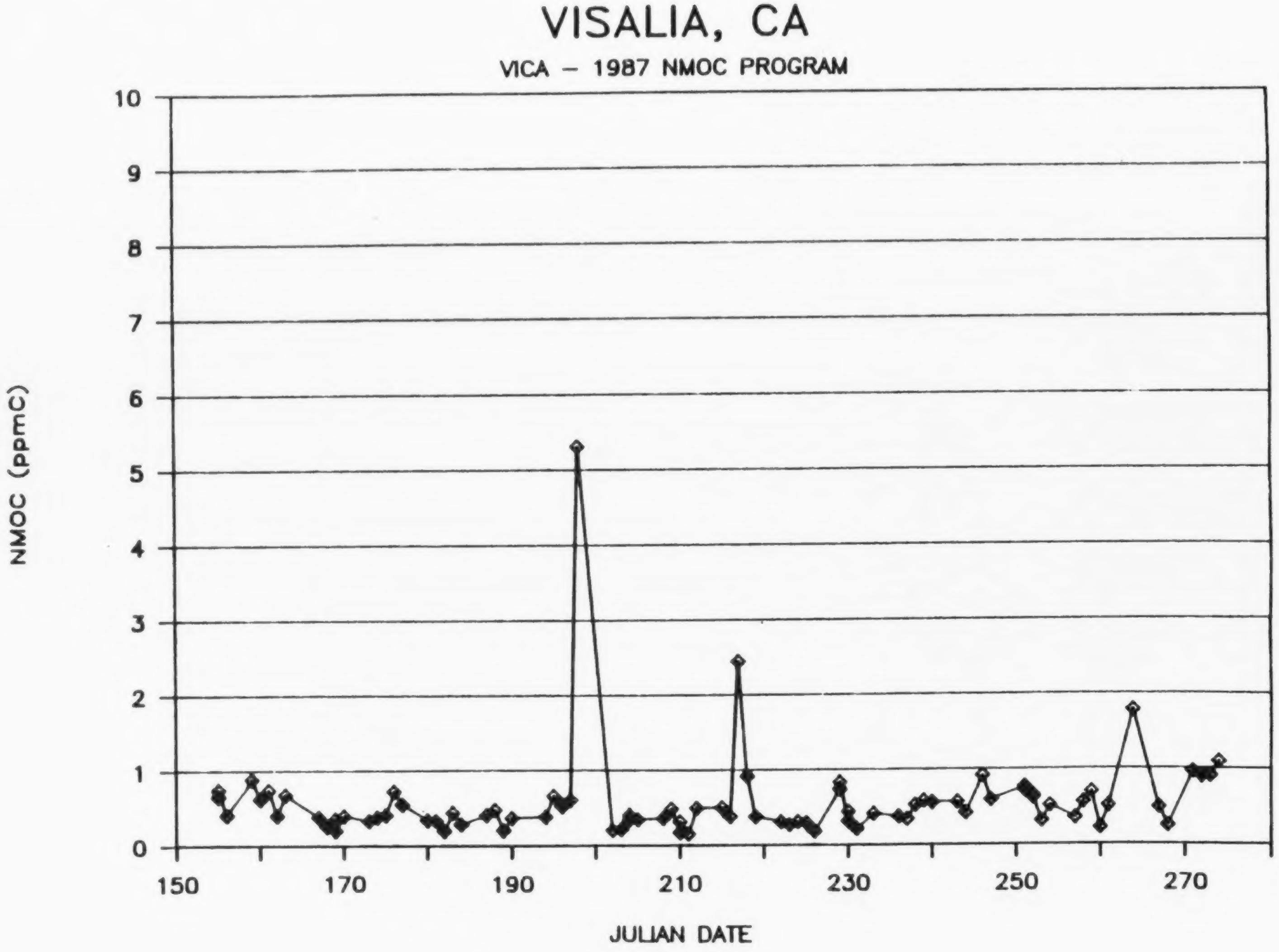

Figure 2-31. Plot of NMOC concentration for Visalia, CA (Expanded).

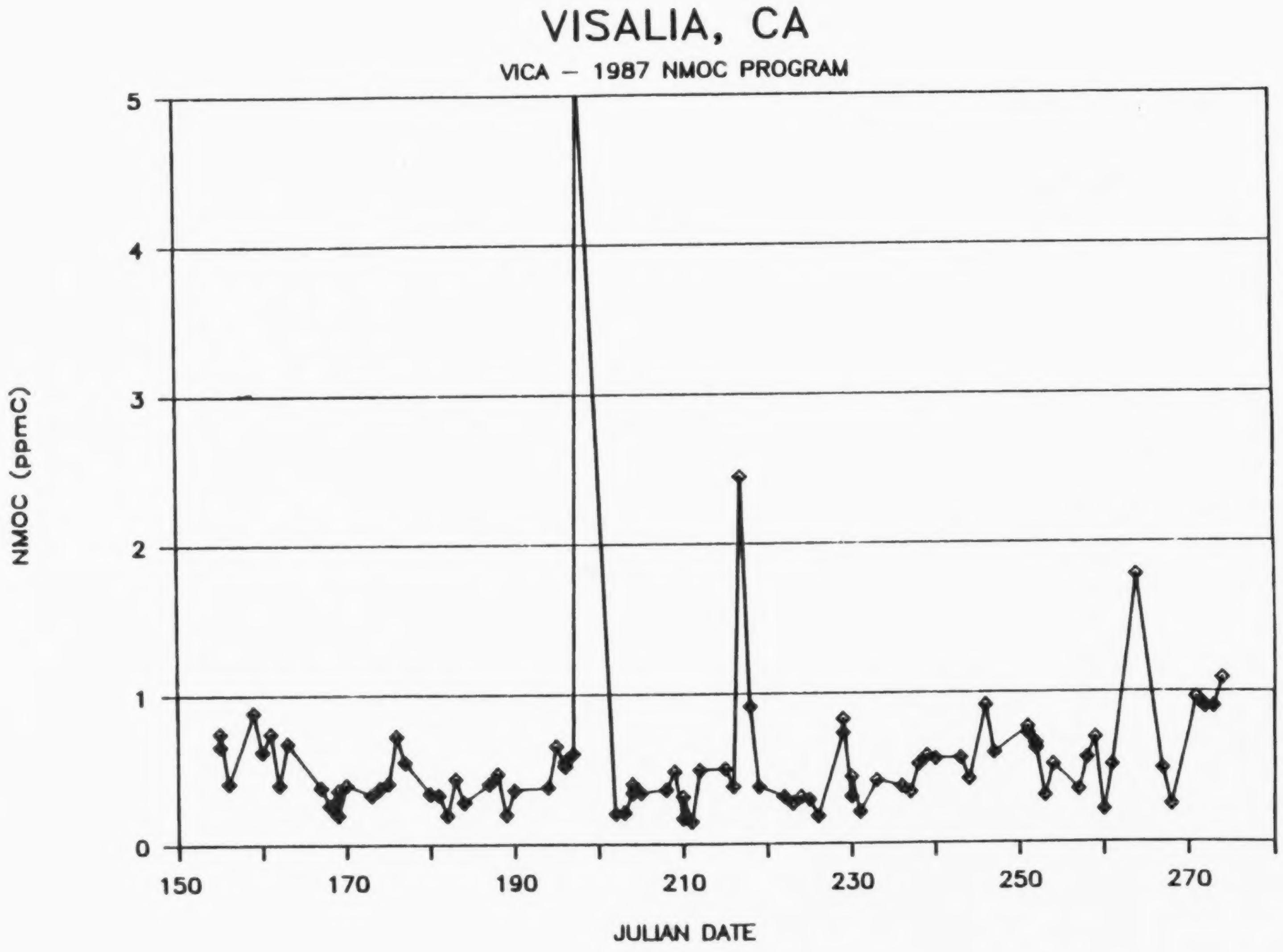

Figure 2-32. Plot of NMOC concentration for Visalia, CA.

TABLE 2-53. SUMMARY OF THE 1987 NMOC DATA FOR VISALIA, CA (VICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/04/87	155	H	1079	652	C	0.660		
06/04/87	155	H	1080	671	D	0.746		
06/05/87	156	F	1102	667	D	0.412		
06/08/87	159	M	1137	664	C	0.885		
06/09/87	160	T	1188	131	D	0.623		
06/10/87	161	W	1204	82	A	0.744		
06/11/87	162	H	1214	122	B	0.403	0.255	0.430
06/12/87	163	F	1231	74	B	0.680		
06/16/87	167	T	1315	171	C	0.382		
06/17/87	168	W	1361	24	A	0.261		
06/18/87	169	H	1423	675	B	0.361		
06/18/87	169	H	1424	96	B	0.200		
06/19/87	170	F	1405	401	D	0.400		
06/22/87	173	M	1454	190	D	0.332		
06/23/87	174	T	1473	73	B	0.380		
06/24/87	175	W	1497	62	D	0.410		
06/25/87	176	H	1546	646	C	0.726	0.578	0.534
06/26/87	177	F	1568	123	B	0.550		0.330
06/29/87	180	M	1590	654	B	0.340		
06/30/87	181	T	1676	72	B	0.332		
07/01/87	182	W	1675	699	D	0.196		
07/02/87	183	H	1707	106	C	0.438		
07/03/87	184	F	1705	405	B	0.280		
07/06/87	187	M	1738	407	D	0.405		
07/07/87	188	T	1773	119	B	0.472	0.535	0.573
07/08/87	189	W	1807	180	D	0.200		
07/09/87	190	H	1880	185	A	0.363		
07/13/87	194	M	1926	700	B	0.381		
07/14/87	195	T	1934	302	A	0.656	0.649	0.506
07/15/87	196	W	1966	92	B	0.520		
07/15/87	196	W	1966	92	D	0.551		
07/16/87	197	H	2011	17	B	0.606		
07/17/87	198	F	2021	109	C	5.309		4.954
07/21/87	202	T	2112	118	D	0.205		
07/22/87	203	W	2127	693	A	0.213		
07/22/87	203	W	2127	693	D	0.212		
07/23/87	204	H	2161	83	D	0.340		
07/23/87	204	H	2161	83	B	0.403		
07/24/87	205	F	2169	406	B	0.343		0.278
07/27/87	208	M	2229	676	B	0.362		0.281
07/28/87	209	T	2272	670	C	0.484		
07/29/87	210	W	2295	61	B	0.170		
07/29/87	210	W	2296	197	C	0.316		

TABLE 2-33. SUMMARY OF THE 1987 NMOC DATA FOR VISALIA, CA (VICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/30/87	211	H	2358	133	A	0.150		
07/31/87	212	F	2385	713	D	0.492		
08/03/87	215	M	2407	658	C	0.500		
08/04/87	216	T	2448	54	A	0.381		
08/05/87	217	W	2468	62	A	2.446		
08/06/87	218	H	2505	112	C	0.916		
08/07/87	219	F	2541	307	D	0.379		
08/10/87	222	M	2568	42	D	0.311		
08/11/87	223	T	2593	170	C	0.267		
08/12/87	224	W	2629	784	B	0.311		
08/13/87	225	H	2688	49	A	0.293		
08/14/87	226	F	2679	64	D	0.182		
08/17/87	229	M	2710	793	B	0.735		
08/17/87	229	M	2710	793	C	0.830		
08/18/87	230	T	2779	197	D	0.313		
08/18/87	230	T	2780	155	D	0.444	0.445	
08/19/87	231	W	2798	56	B	0.212		
08/21/87	233	F	2851	668	D	0.418		
08/24/87	236	M	2881	189	B	0.378		
08/25/87	237	T	2966	172	D	0.341		
08/26/87	238	W	2959	643	A	0.526		
08/27/87	239	W	2989	77	D	0.582		
08/28/87	240	F	3035	726	B	0.561		
08/31/87	243	M	3086	183	C	0.566		
09/01/87	244	T	3117	4	D	0.424		
09/03/87	246	H	3168	185	D	0.917		
09/04/87	247	F	3192	800	B	0.597		
09/08/87	251	T	3219	761	D	0.769		
09/08/87	251	T	3219	761	B	0.727		
09/09/87	252	W	3247	403	B	0.659		
09/09/87	252	W	3248	149	B	0.623		
09/10/87	253	H	3275	79	C	0.313		
09/11/87	254	F	3334	783	B	0.518		0.465
09/14/87	257	M	3395	620	C	0.352		0.276
09/15/87	258	T	3388	165	A	0.562		
09/16/87	259	W	3479	761	C	0.698		
09/17/87	260	H	3457	793	C	0.220		
09/18/87	261	F	3475	191	C	0.514		
09/21/87	264	M	3558	635	C	1.782		
09/24/87	267	H	3618	632	D	0.488		
09/25/87	268	F	3640	108	A	0.249		
09/28/87	271	M	3734	301	D	0.961		
09/29/87	272	T	3745	618	A	0.900		

TABLE 2-33. SUMMARY OF THE 1987 NMOC DATA FOR VISALIA, CA (VICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/29/87	272	T	3746	302	A	0.906		
09/30/87	273	W	3809	728	C	0.902		
10/01/87	274	H	3794	7	D	1.090		

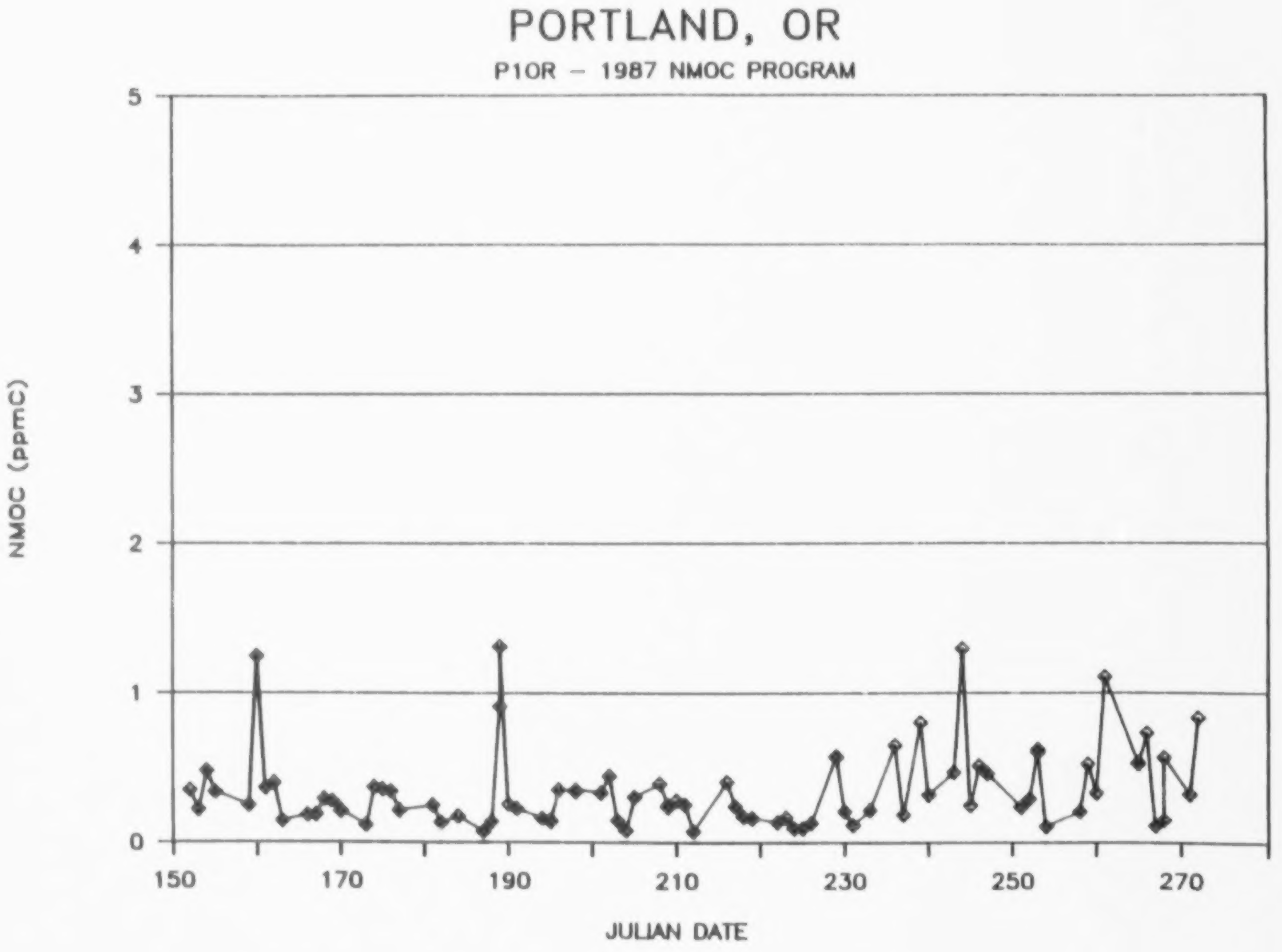

Figure 2-33. Plot of NMOC concentration for Portland, OR.

TABLE 2-34. SUMMARY OF THE 1987 NMOC DATA FOR PORTLAND, OR (P1OR)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
06/01/87	152	M	1016	409	B	0.351	0.715	
06/02/87	153	T	1051	49	C	0.223		
06/03/87	154	W	1030	153	C	0.478		
06/04/87	155	H	1087	68	D	0.338		
06/08/87	159	M	1172	56	B	0.250		
06/09/87	160	T	1175	123	B	1.246		
06/10/87	161	W	1208	187	C	0.366		
06/11/87	162	H	1215	409	B	0.399		0.430
06/12/87	163	F	1269	111	D	0.145		
06/15/87	166	M	1295	112	D	0.185		
06/16/87	167	T	1316	135	D	0.189		
06/17/87	168	W	1311	131	A	0.293		
06/18/87	169	H	1374	187	B	0.273		
06/18/87	169	H	1374	187	D	0.275		
06/19/87	170	F	1417	137	B	0.210	0.198	0.186
06/19/87	170	F	1422	12	C	0.214		
06/22/87	173	M	1438	306	D	0.117		
06/23/87	174	T	1475	703	A	0.371		
06/24/87	175	W	1498	134	C	0.356		
06/25/87	176	H	1547	21	B	0.344		
06/26/87	177	F	1572	710	C	0.217	0.202	0.189
06/30/87	181	T	1647	301	D	0.250		
07/01/87	182	W	1673	99	C	0.134		
07/03/87	184	F	1758	40	D	0.177		
07/06/87	187	M	1754	1334	A	0.073		
07/07/87	188	T	1774	4	B	0.140		
07/08/87	189	W	1810	109	C	0.914		
07/08/87	189	W	1811	191	C	1.313		
07/09/87	190	H	1863	103	A	0.258		
07/10/87	191	F	1895	140	C	0.228		
07/13/87	194	M	1931	73	D	0.164		
07/14/87	195	T	1932	683	B	0.141		
07/14/87	195	T	1932	683	C	0.152		
07/15/87	196	W	1990	689	B	0.355	0.382	0.306
07/17/87	198	F	2049	688	C	0.344		
07/17/87	198	F	2049	688	B	0.354		
07/20/87	201	M	2113	116	A	0.333		
07/21/87	202	T	2152	72	D	0.447		
07/22/87	203	W	2190	126	B	0.149		
07/23/87	204	H	2212	53	D	0.081		
07/24/87	205	F	2259	108	C	0.305		
07/27/87	208	M	2245	48	D	0.396		
07/28/87	209	T	2362	102	B	0.252		0.222

TABLE 2-34. SUMMARY OF THE 1987 NMOC DATA FOR PORTLAND, OR (P1OR)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/28/87	209	T	2363	97	B	0.240		
07/29/87	210	W	2303	719	A	0.285		
07/30/87	211	H	2366	680	A	0.255		
07/31/87	212	F	2382	193	A	0.076		
08/04/87	216	T	2451	673	A	0.408		
08/05/87	217	W	2525	138	A	0.245		
06/06/87	218	H	3496	637	B	0.175		
08/07/87	219	F	2558	68	A	0.167		
08/07/87	219	F	2558	68	A	0.163		
08/10/87	222	M	2589	171	C	0.138		
08/11/87	223	T	2639	634	C	0.169		
08/12/87	224	W	2636	157	B	0.095		
08/13/87	225	H	2692	697	B	0.096		
08/14/87	226	F	2721	653	B	0.131		
08/17/87	229	M	2715	57	C	0.579	0.589	
08/17/87	229	M	2737	152	D	0.569		
08/18/87	230	T	2789	177	C	0.210		
08/19/87	231	W	2808	641	C	0.118		
08/21/87	233	F	2892	672	B	0.219		
08/24/87	236	M	2950	165	D	0.652		
08/25/87	237	T	2949	719	D	0.188		
08/27/87	239	H	2980	772	D	0.803	0.832	
08/28/87	240	F	3050	103	B	0.320		
08/31/87	243	M	3083	796	B	0.473		
09/01/87	244	T	3129	308	C	1.299		
09/02/87	245	W	3158	153	C	0.251	0.199	
09/03/87	246	H	3190	49	A	0.514		
09/04/87	247	F	3203	184	A	0.464		
09/08/87	251	T	3260	9	C	0.240		
09/09/87	252	W	3281	707	A	0.294		0.239
09/10/87	253	H	3300	93	B	0.625		
09/10/87	253	H	3301	154	C	0.603		
09/11/87	254	F	3370	157	C	0.110		
09/15/87	258	T	3421	185	B	0.210		
09/16/87	259	W	3432	176	A	0.525		
09/17/87	260	H	3467	800	B	0.335		
09/18/87	261	F	3518	56	C	1.109		
09/22/87	265	T	3666	669	A	0.534		
09/22/87	265	T	3667	99	D	0.527		
09/23/87	266	W	3643	133	A	0.732		
09/24/87	267	H	3648	688	C	0.114		
09/25/87	268	F	3682	771	B	0.154		
09/25/87	268	F	3683	718	D	0.570		

TABLE 2-34. SUMMARY OF THE 1987 NMOC DATA FOR PORTLAND, OR (P1OR)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/28/87	271	M	3719	797	D	0.327		0.297
09/29/87	272	T	3805	786	D	0.836		

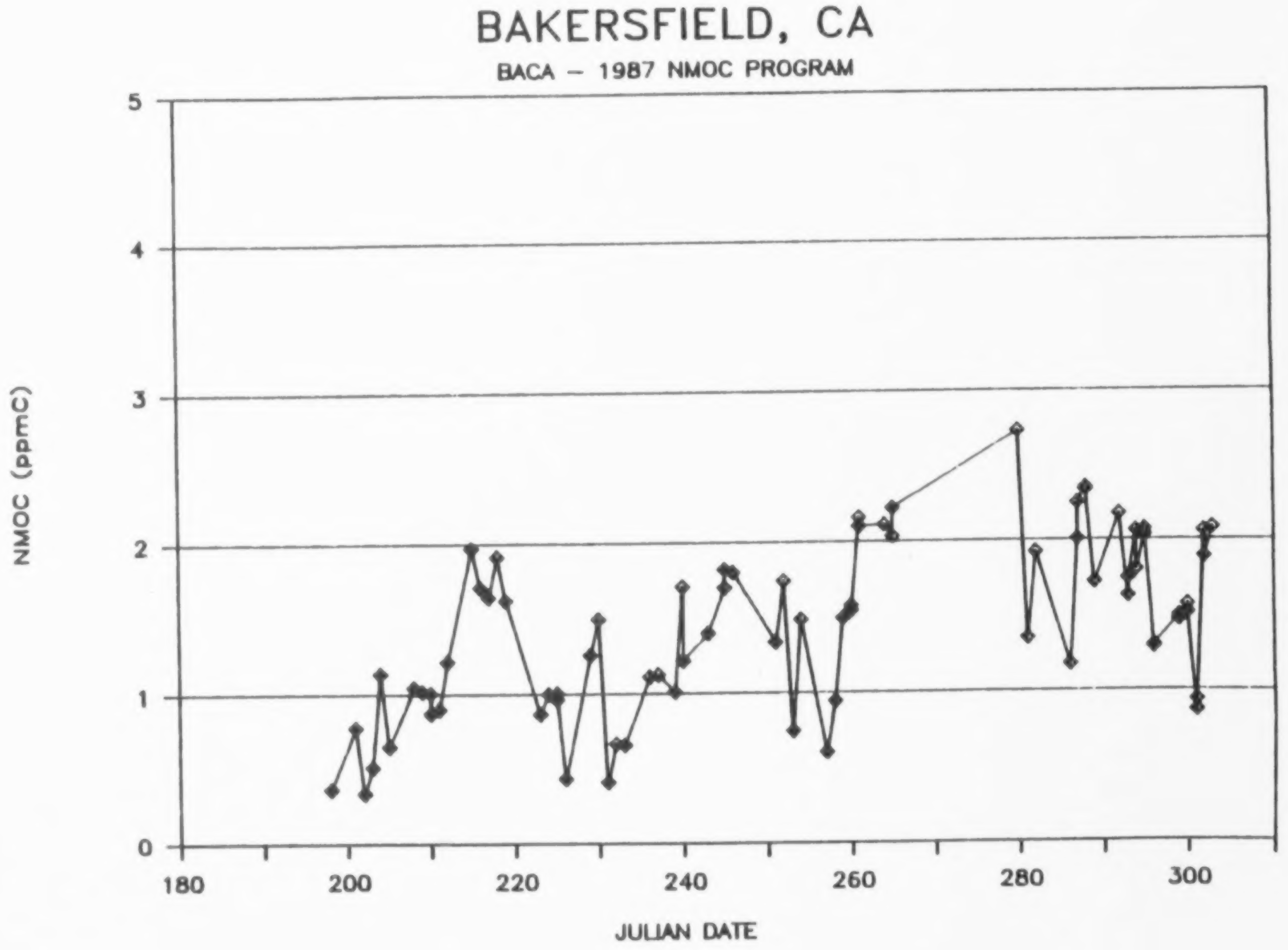

Figure 2-34. Plot of NMOC concentration for Bakersfield, CA.

TABLE 2-35. SUMMARY OF THE 1987 NMOC DATA FOR BAKERSFIELD, CA (BACA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/17/87	198	F	1995	652	B	0.368		0.448
07/20/87	201	M	2086	680	A	0.779		
07/21/87	202	T	2102	86	B	0.341		
07/22/87	203	W	2150	189	D	0.514		
07/23/87	204	H	2206	123	A	1.137		
07/24/87	205	F	2175	60	C	0.652		
07/27/87	208	M	2257	688	B	1.044		
07/28/87	209	T	2264	642	D	1.020	1.021	1.153
07/29/87	210	W	2290	165	C	1.009		
07/29/87	210	W	2290	165	B	0.873		
07/30/87	211	H	2347	79	C	0.902		
07/31/87	212	F	2368	55	D	1.215		
08/03/87	215	M	2409	714	B	1.968		
08/04/87	216	T	2431	82	D	1.710		
08/05/87	217	W	2458	79	C	1.647		
08/06/87	218	H	2485	97	D	1.913	1.653	
08/07/87	219	F	2503	694	C	1.625		
08/11/87	223	T	2582	641	D	0.868	0.721	
08/12/87	224	W	2635	644	C	1.000		
08/13/87	225	H	2665	718	B	0.964		
08/13/87	225	H	2678	694	D	1.006		
08/14/87	226	F	2669	632	B	0.436		
08/17/87	229	M	2744	725	C	1.259		
08/18/87	230	T	2758	164	D	1.498		
08/19/87	231	W	2806	43	C	0.414		
08/20/87	232	H	2818	95	C	0.668		
08/21/87	233	F	2839	705	B	0.661		
08/24/87	236	M	2900	649	C	1.113		
08/25/87	237	T	2918	173	C	1.127		
08/27/87	239	H	3002	3	A	1.010		
08/28/87	240	F	3026	71	C	1.709		
08/28/87	240	F	3027	641	C	1.217		
08/31/87	243	M	3059	42	C	1.400		
09/02/87	245	W	3104	10	C	1.700		
09/02/87	245	W	3104	10	C	1.821		
09/03/87	246	H	3154	194	D	1.801		
09/08/87	251	T	3226	119	B	1.336		
09/09/87	252	W	3245	650	D	1.742		1.580
09/10/87	253	H	3288	673	D	0.747		
09/11/87	254	F	3319	688	C	1.486		
09/14/87	257	M	3362	87	B	0.603		0.465
09/15/87	258	T	3397	194	B	0.945		
09/16/87	259	W	3463	169	D	1.493		

TABLE 2-35. SUMMARY OF THE 1987 NMOC DATA FOR BAKERSFIELD, CA (BACA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
09/17/87	260	H	3449	720	D	1.578		
09/17/87	260	H	3449	720	A	1.544		
09/18/87	261	F	3501	405	D	2.159		1.916
09/18/87	261	F	3501	405	B	2.100		1.916
09/21/87	264	M	3527	111	C	2.112		2.075
09/22/87	265	T	3568	105	A	2.035		
09/22/87	265	T	3569	155	D	2.223		
10/07/87	280	W	3815	66	D	2.733		2.368
10/08/87	281	H	3817	163	C	1.354		
10/09/87	282	F	3820	11	C	1.920		
10/13/87	286	T	3822	720	C	1.176		
10/14/87	287	W	3824	123	A	2.008		
10/14/87	287	W	3823	404	D	2.251		
10/15/87	288	H	3830	111	C	2.350		
10/15/87	288	H	3829	131	B	2.337		
10/16/87	289	F	3828	53	A	1.722		
10/19/87	292	M	3833	782	A	2.173		
10/20/87	293	T	3836	172	D	1.628		
10/20/87	293	T	3837	649	C	1.744		
10/21/87	294	W	3838	91	D	2.061		
10/21/87	294	W	3839	193	C	1.802		
10/22/87	295	H	3842	12	C	2.032		
10/22/87	295	H	3843	13	D	2.070		
10/23/87	296	F	3844	406	D	1.288		
10/23/87	296	F	3845	196	C	1.301		
10/26/87	299	M	3848	70	B	1.498		
10/26/87	299	M	3849	632	A	1.468		
10/27/87	300	T	3854	135	B	1.570		
10/27/87	300	T	3855	116	A	1.515		
10/28/87	301	W	3856	623	D	0.868		
10/28/87	301	W	3857	164	C	0.939		
10/29/87	302	H	3862	182	B	2.058		
10/29/87	302	H	3863	188	A	1.887		
10/30/87	303	F	3864	54	A	2.082		

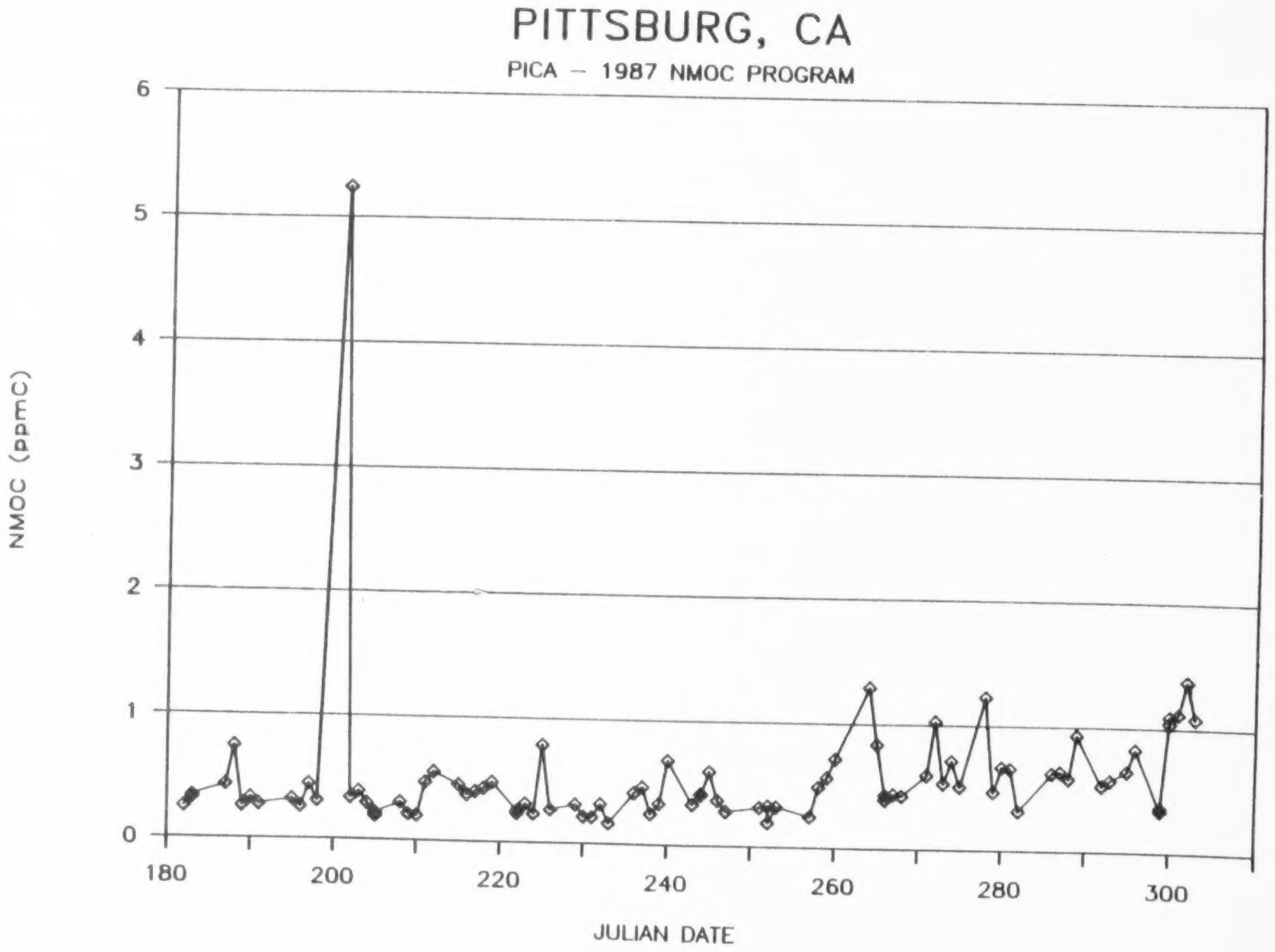

Figure 2-35. Plot of NMOC concentration for Pittsburg, CA (Expanded).

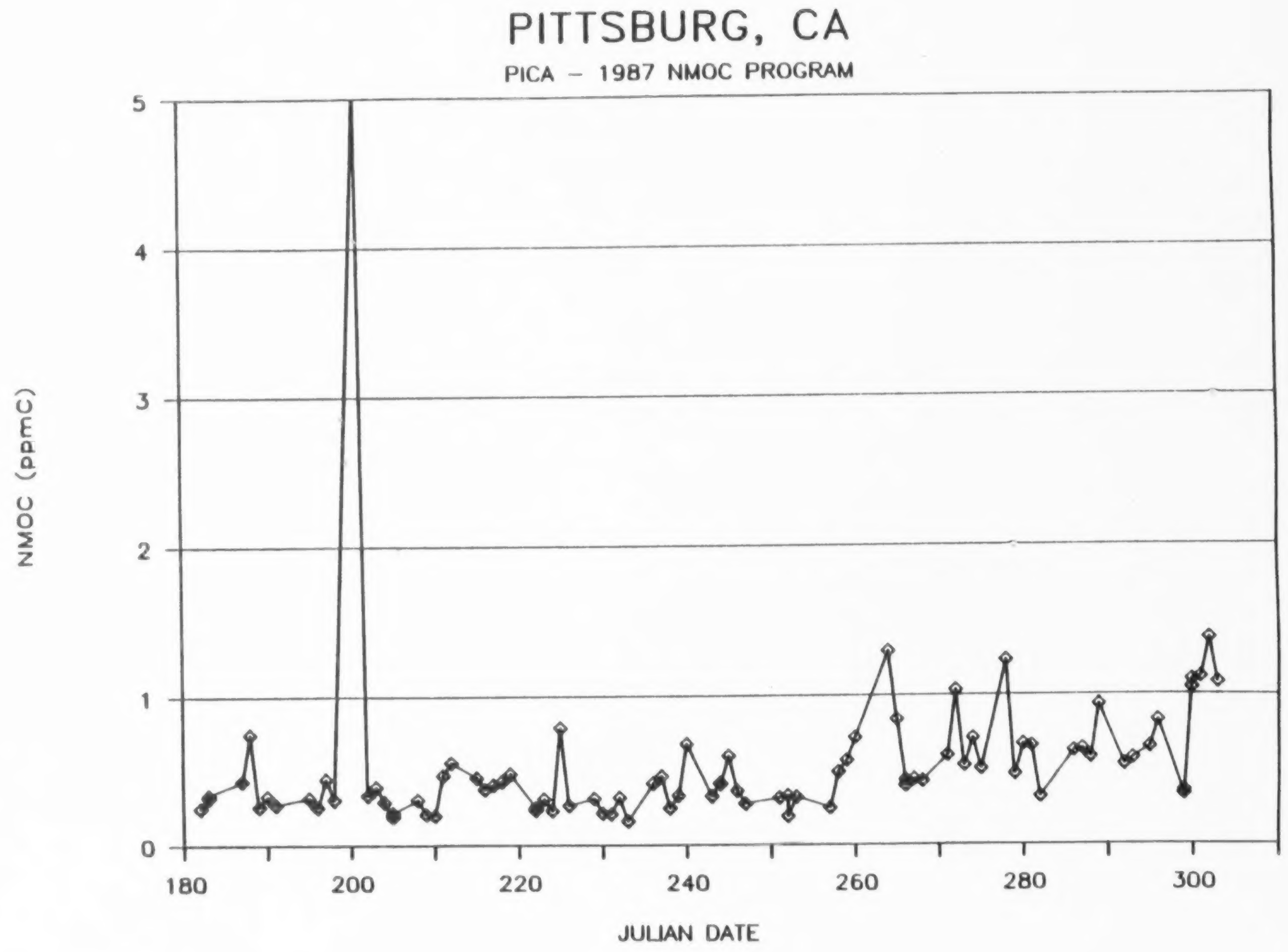

Figure 2-36. Plot of NMOC concentration for Pittsburg, CA.

TABLE 2-36. SUMMARY OF THE 1987 NMOC DATA FOR PITTSBURG, CA (PICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
07/01/87	182	W	1655	183	A	0.254		
								*
07/02/87	183	H	1680	679	C	0.324		
07/02/87	183	H	1681	669	D	0.339		
07/06/87	187	M	1759	6	D	0.435		
07/07/87	188	T	1788	703	C	0.747		
07/08/87	189	W	1809	115	B	0.262		
07/09/87	190	H	1879	98	B	0.331		
07/10/87	191	F	1840	680	B	0.275	0.361	0.183
07/14/87	195	T	1958	675	A	0.321		
07/15/87	196	W	1977	191	A	0.258		
07/16/87	197	H	1973	171	A	0.446	0.440	0.391
07/17/87	198	F	2036	115	D	0.310		
07/20/87	201	M	2066	730	C	5.244		
07/20/87	201	M	2066	730	C	5.241		
07/21/87	202	T	2068	91	C	0.338		
07/22/87	203	W	2128	22	C	0.392		
07/23/87	204	H	2186	685	C	0.292	0.345	0.267
07/24/87	205	F	2197	409	A	0.193		
07/24/87	205	F	2202	64	B	0.218		
07/27/87	208	M	2246	100	D	0.308		
07/28/87	209	T	2225	716	D	0.212	0.260	0.161
07/29/87	210	W	2289	407	D	0.202		
07/30/87	211	H	2297	636	D	0.471		
07/31/87	212	F	2367	301	D	0.557		
08/03/87	215	M	2377	113	A	0.454		0.398
08/04/87	216	T	2435	89	A	0.376		
08/05/87	217	W	2456	20	D	0.406		
08/06/87	218	H	2509	3	D	0.431		
08/07/87	219	F	2539	130	C	0.481		
08/10/87	222	M	2566	693	A	0.254		
08/10/87	222	M	2567	726	D	0.236		
08/11/87	223	T	2604	37	B	0.313		
08/12/87	224	W	2606	672	A	0.234		
08/13/87	225	H	2693	790	C	0.789		
08/14/87	226	F	2656	32	D	0.268		
08/17/87	229	M	2718	90	D	0.315		
08/18/87	230	T	2750	673	A	0.217		
08/19/87	231	W	2797	657	A	0.212		
08/20/87	232	H	2846	693	D	0.320		
08/21/87	233	F	2816	642	A	0.164	0.220	
08/24/87	236	M	2888	187	C	0.416		
08/25/87	237	T	2921	49	D	0.464		

TABLE 2-36. SUMMARY OF THE 1987 NMOC DATA FOR PITTSBURG, CA (PICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
08/26/87	238	W	2911	662	B	0.251		
08/27/87	239	H	3005	116	A	0.334		
08/28/87	240	F	3008	798	A	0.681		
08/31/87	243	M	3062	720	A	0.330	0.371	
09/01/87	244	T	3100	637	D	0.419		
09/01/87	244	T	3101	677	D	0.409		
09/02/87	245	W	3120	632	D	0.597		
09/03/87	246	H	3162	92	D	0.366		
09/04/87	247	F	3174	501	C	0.279		
09/08/87	251	T	3236	762	B	0.318		
09/09/87	252	W	3250	71	D	0.331		0.288
09/09/87	252	W	3337	180	B	0.195		0.172
09/10/87	253	H	3308	783	D	0.322		
09/14/87	257	M	3371	641	A	0.250		
09/15/87	258	T	3385	791	B	0.489		0.271
09/16/87	259	W	3437	156	C	0.568		
09/17/87	260	H	3487	119	C	0.718		
09/21/87	264	M	3517	19	A	1.294		
09/22/87	265	T	3545	681	C	0.840		
09/23/87	266	W	3599	798	B	0.435		
09/23/87	266	W	3600	183	B	0.395		
09/24/87	267	H	3663	672	C	0.440		
09/25/87	268	F	3674	161	C	0.428		0.332
09/28/87	271	M	3681	639	A	0.598		
09/29/87	272	T	3728	620	C	1.033		
09/30/87	273	W	3765	781	D	0.532		
10/01/87	274	H	3761	183	C	0.713		
10/02/87	275	F	3795	187	D	0.508		
10/05/87	278	M	3810	780	C	1.232		
10/06/87	279	T	3813	701	D	0.472		0.517
10/07/87	280	W	3814	716	C	0.671		
10/08/87	281	H	3816	772	D	0.661		
10/09/87	282	F	3818	156	C	0.319		
10/13/87	286	T	3821	774	D	0.626		
10/14/87	287	W	3825	785	B	0.640		
10/15/87	288	H	3826	688	D	0.585		
10/16/87	289	F	3827	639	C	0.934		
10/19/87	292	M	3832	786	B	0.534		
10/20/87	293	T	3834	646	A	0.575		
10/22/87	295	H	3840	784	C	0.652		
10/23/87	296	F	3841	68	D	0.828		
10/26/87	299	M	3850	149	A	0.338		
10/26/87	299	M	3851	36	B	0.363		

TABLE 2-36. SUMMARY OF THE 1987 NMOC DATA FOR PITTSBURG, CA (PICA)

Date Sampled	Julian Date Sampled	Weekday Sampled	Sample ID Number	Sample Canister Number	Radian Channel	Radian NMOC (ppmC)	QAD NMOC (ppmC)	ASRL NMOC (ppmC)
10/27/87	300	T	3852	500	A	1.044		
10/27/87	300	T	3853	147	B	1.100		
10/28/87	301	W	3858	15	C	1.118		
10/29/87	302	H	3861	89	A	1.379		
10/30/87	303	F	3860	129	B	1.081		

*Sampling period for Julian Date 182 occurred from 6:00 AM to 9:00 AM.
Sampling period beginning Julian Date 183 occurred from 12:00 Noon to 3:00 PM.

- Radian Channel A, B, C, or D;
- Radian NMOC, ppmC determined by Radian Channel A, B, C, or D,;
- QAD NMOC, ppmC, determined by EPA-QAD channel; and
- ASRL NMOC, ppmC, determined by EPA-ASRL channel.

3.0 NMOC TECHNICAL NOTES

This section includes instructions on the installation and operation of the field sampling equipment, a summary of the analytical equipment and procedures for NMOC measurement, and a description of the canister cleanup equipment and procedure.

3.1. NMOC SAMPLING EQUIPMENT

The field sampling equipment used in the collection of ambient air samples for NMOC measurement is described in detail in Appendix A. The notes presented below outline site installation instructions, operating instructions, and suggestions for correcting certain operating difficulties.

3.1.1 Installation

The following general instructions outline the requirements for installing the ambient NMOC sampling equipment at the sample site, including a checklist of instructions necessary for operator training.

1. Locate the sampler as close to the sample inlet point as is convenient. The location should be in a temperature controlled (70° to 85°F) area with space which provides access to the equipment and with sufficient electrical power to operate the equipment.

2. Make sure that the electrical solenoid valve is installed on the pump outlet. The solenoid valve should have a tee fitting on top, one port of which is plugged during single sample collection and unplugged and attached to a second sample canister during duplicate sample collection.

3. Verify that the inlet to the pump has a flow-control orifice/filter assembly mounted on it. An orifice assembly marked with an "S" is used for single sample collections; an orifice assembly marked with a "D" is used for duplicate sample collections.

4. Connect a 1/8-inch stainless steel inlet line from the top of the orifice/filter assembly to the inlet manifold. This should be the same manifold used by the NOx monitor. The manifold inlet port selected for NMOC sampling should be the first port (closest to atmosphere) on a multiple port manifold.

If there is no inlet manifold, install a suitable inlet line of 1/4-inch chromatographic-grade stainless steel to the sampling point. Avoid using any plastic parts, including Teflon^{R}, in the sample inlet. The sample inlet should be kept as short as possible and installed so that it will drain by gravity and not collect water. If it is necessary to use a long sample inlet line (over 10 to 12 feet from the sample pump to the manifold or sample point), a small vacuum pump should be connected to the exit of the inlet line tee to keep the inlet purged during sampling. The local agencies for whom the samples are being collected are asked to supply the small vacuum pump, if needed, and any other incidental items necessary to connect the sampler to the sample inlet point.

5. Connect the pump and the solenoid valve to the timer, and connect the timer to an electrical power outlet. Set the timer to the correct local time by turning the large dial in a clockwise direction only. Clock time should be checked daily and reset as necessary.

6. Verify that the pump and timer switch are operational by turning the timer switch ON and OFF. The solenoid valve is a special latching valve with a time-delay power circuit. It may not operate properly if the timer switch is turned ON and OFF too rapidly. The switch must be left in the ON or OFF position at least 20 seconds before it is switched to the opposing position for proper valve actuation.

7. Disconnect the sample inlet from the top of the filter assembly and connect the rotameter to the filter assembly, holding or mounting the rotameter in a vertical position. Start the pump and record the flowmeter reading. Remove the "S" orifice assembly, install the "D" orifice assembly, and record the flowmeter reading. Turn the timer switch OFF and reconnect the solenoid valve. Disconnect the rotameter, reinstall the "S" orifice assembly, and reconnect the sample inlet to the filter assembly.

8. Instruct the site operator in the following:

   1. Installing canister(s),
   2. Turning the solenoid valve on and off, emphasizing the 20-second time delay,
   3. Measuring flow with a rotameter,
   4. Changing orifice assemblies,
   5. Changing filter element,
   6. Tightening Swagelok^{R} fittings correctly,
   7. Setting timer, and adjustment of ON/OFF dogs,
   8. Filling out field sample data forms,
   9. Sampling procedure,
   10. Troubleshooting instructions, (Section 3.1.4 below), and
   11. Identifying person(s) to call at Radian Research Triangle Park (RTP) if problems are encountered.

3.1.2 Operation - Presampling

The following instructions pertain to the sampling operation prior to collection of the sample(s).

1. Set the timer to the correct day and time, clockwise advance only. Verify that the ON/OFF dogs are in their correct positions on the timer disk.

2. With no canisters connected to the sampling system, turn the timer switch to the OFF position.

3. Disconnect the sample inlet from the top of the orifice/filter assembly mounted on the pump inlet. Connect the rotameter to the top of the orifice/filter assembly. Hold or mount the rotameter vertically.

4. After the timer switch has been OFF at least 20 seconds, turn the timer switch ON. The pump should run and the latching valve should open. Verify that the rotameter reading is approximately the same (±15%) as the reading obtained during installation. If the rotameter reading is not correct, see the troubleshooting instructions.

5. Allow the pump to run for at least 20 seconds, then turn the timer switch OFF.

6. Connect a cleaned, evacuated canister to the sampling system. If duplicate samples are to be collected, remove the plug from the second port of the tee and connect a second canister to the sampling system. Remove the orifice assembly marked with an "S", but do not remove the filter assembly. Install the orifice assembly marked with a "D". After obtaining scheduled duplicate samples, replace the plug and the "S" orifice assembly to return to single sample collection status.

7. With the pump off, open completely the valve on the canister (or on one of the canisters if two are connected) and verify that no flow is registered on the rotameter. If any flow is detected by the rotameter, immediately close the canister valve and refer to the troubleshooting instructions (Table 3-1).

8. If no flow is observed, disconnect the rotameter and reconnect the inlet sample line to the filter assembly. If two canisters are connected, completely open the valve on the second canister.

9. Reverify that the canister valve(s) is(are) completely open and the timer is properly set for sampling from 6 to 9 AM the next weekday.

3.1.3 Operation - Postsampling

The following instructions pertain to the postsampling operation after collection of sample(s).

1. Close the canister valve(s) firmly. Disconnect the canister(s) from the sampling system.

2. Connect the pressure gauge to the canister inlet and open the canister valve. Record the canister pressure on the field sampling data form. Close the canister valve and remove the pressure gauge. Repeat pressure measurement for second canister if you are collecting a duplicate sample.

3. Fill in the required information on the field sample data form(s).

4. Verify that the timer shows the correct time setting. If not, note that fact on the field sample data form along with any information pertaining to the possible cause. Reset the timer to the correct time, if necessary.

5. Verify that the canister valve(s) are closed firmly. Do not overtighten them. Put the protective cap(s) on the valve(s) and prepare the canister(s) for shipment to Radian (RTP).

3.1.4 Troubleshooting Instructions

In Table 3-1, several potential problems that may occur in the sample collection procedure are identified, and suggested measures are listed to correct the problem. In every case that a problem occurs, it is recommended that Radian (RTP) be notified.

3.2 NMOC ANALYSIS

The NMOC analysis equipment and analysis procedure are described in greater detail in Appendix A. A brief description of the equipment and operating procedure used in this study follows.

3.2.1 Instrumentation

Two gas chromatographs were used by Radian. Each was a dual-channel Hewlett-Packard Model 5880 (HP-5880) using flame ionization detection (FID). NMOC instrument Channels A and B refer to the two FIDs on one HP-5880 unit, and Channels C and D refer to the two FIDs on the other HP-5880 unit. These chromatographs were modified similar to the prototype unit (EPA-QAD instrument), which is described in Appendix A. The EPA-QAD was used as a quality assurance check during this program. In addition, an HP-5880 gas chromatograph equipped with a 60 m x 0.32 mm i.d., DB-1, fused silica capillary column was used as the gas speciation method and as a quality assurance check. This capillary column instrument is called EPA-ASRL Channel in subsequent sections of this report.

TABLE 3-1. TROUBLESHOOTING NMOC AMBIENT SAMPLING PROCEDURE

Diagnostic	Recommended Correction
Rotameter flow too low	1. Make sure pump is running. 2. Valve may not be open. Turn timer switch OFF, wait 20 seconds, then turn the switch ON. 3. Disconnect the solenoid valve from pump. If flow is then correct, solenoid valve may be defective. Consult Radian (RTP). 4. Needle may be plugged. Replace orifice assembly (not filter) with spare "S" orifice assembly. If flow is correct, return defective orifice assembly with note of explanation to Radian (RTP) for replacement. 5. Filter may be plugged. Remove filter and assess whether flow is correct. If flow is correct, install spare filter element in filter assembly and reattach to orifice assembly. Return defective filter element with note of explanation to Radian (RTP) for replacement.
Rotameter flow too high	1. Check for leaks. 2. Try spare orifice assembly. If flow is correct, return defective orifice assembly to Radian (RTP) for replacement.
Flow is detected with canister valve open and pump off	1. Solenoid valve not closed. Turn off canister valve. Turn timer switch ON, wait 20 seconds, then turn timer switch OFF. Open canister valve and check again. If flow is still detected, consult Radian (RTP).
Canister pressure over 20 psig after sampling	1. Check flow rate. 2. Check for leaks; tighten all fittings. 3. Check timer for correct position of ON/OFF dogs. 4. Canister may have leaked or may not have been completely evacuated. Note on sample form and collect the next scheduled sample. If the next sample also has excessive pressure, consult Radian (RTP).

3.2.2 Hewlett-Packard, Model 5880, Gas Chromatograph Operating Conditions

The sample trap consisted of 30 cm of 1/8-inch outside diameter (o.d.) stainless steel tubing, packed with 60/80 mesh glass beads.

Three support gases were used in this analysis: helium, hydrogen, and hydrocarbon-free air. Details of their use are given below in Table 3-2.

Table 3-2. SUPPORT GAS OPERATING CONDITIONS

Purpose	Cylinder Composition	Pressure	Mean Flow Rate[a]
Carrier Gas	Helium	30 psig	30.4 mL/min
FID Air	Hydrocarbon-free air	30 psig	356.9 mL/min
FID Fuel	Hydrogen	32 psig	27.9 mL/min

[a] Flow rates corrected to standard conditions (1 atmosphere pressure, 0°C).

The operating temperatures of the HP-5880 were controlled for the NMOC analysis. The FID and auxiliary area were controlled at 250°C and 90°C, respectively. The oven temperature was programmed from 30°C to 90°C at a rate of 30°C per minute for four minutes, holding at 90°C for the fourth minute. Oven and integration parameters were controlled by HP Level 4 programmable integrators. A complete listing of the integrator programming sequence for NMOC measurement by the PDFID method is given in Appendix B.

3.2.3 NMOC Analytical Technique

The modified HP-5880, dual-FID chromatographs were operated during the 1987 study according to the Standard Operating Procedure (SOP) listed in Appendix C. Further description is given below to help explain the analytical apparatus and procedure.

The six-port valve shown in Figure 3-1 was installed in the auxiliary heated zone of the HP-5880 and was pneumatically actuated using the chromatographic valve control signals to apply either compressed air or vacuum to the valve. The sample trap itself was located inside the chromatograph's column oven. A section of 1/16-inch o.d. stainless steel tubing was sized to a length

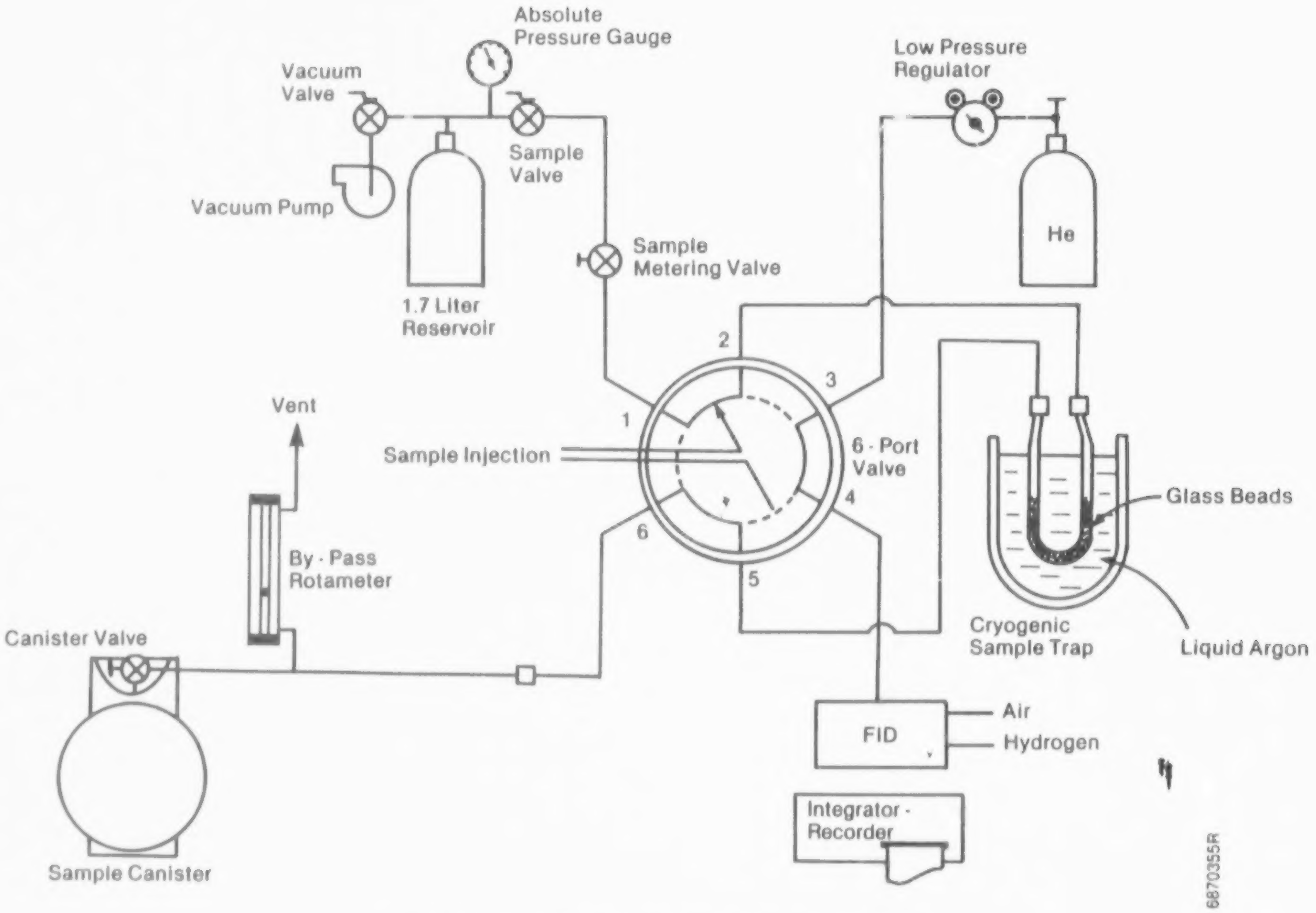
Absolute Pressure Gauge
Vacuum Valve
Sample Valve
Vacuum Pump
1.7 Liter Reservoir
Sample Metering Valve
Low Pressure Regulator
He
1
2
3
4
5
6
Sample Injection
6 - Port Valve
Vent
By - Pass Rotameter
Glass Beads
Cryogenic Sample Trap
Liquid Argon
Canister Valve
Sample Canister
FID
Air
Hydrogen
Integrator - Recorder
6870355R

Figure 3-1. NMOC analytical equipment.

which prevented pressure and flow surges from extinguishing the FID flame. This length was determined experimentally and is different between chromatographs and between channels within chromatographs. This length of tubing effectively substitutes for the pressure restriction provided by a column, but does not perform its speciation function.

During sample trapping, a slight excess of sample gas flow was maintained. A pressure change of 80 mm Hg in a 1.7-liter vacuum reservoir was used to gauge and control the volume of sample gas cryogenically trapped. After the trapping cycle was complete, the HP-5880 program shown in Appendix B was initiated. When the program triggered a horn emitting an audible beep, the cryogen was removed from the trap and the oven door was closed. The chromatographic program then assumed control of raising the oven temperature, at a preset rate, to release the trapped sample to the FID, as well as setting up the integration parameters.

3.3 CANISTER CLEANUP SYSTEM

A cleanup cycle consisted of first pulling a vacuum of 5 mm Hg absolute pressure in the canister, followed by pressurizing the canister to 40 psig with cleaned, dried air that had been humidified. This cycle was repeated three times during the canister cleanup procedure. The cleanness of the canister was qualified by PDFID analysis. Upon meeting the cleanness criterion, the canister was evacuated to 5 mm Hg absolute pressure a fourth time, in preparation of shipment to the site.

3.3.1 Canister Cleanup Equipment

A canister cleanup system was developed and used to prepare sample canisters for reuse after analysis. A diagram of the system is shown in Figure 3-2. An oil-free compressor with a twelve-gallon reservoir provided source air for the system. The oil-free compressor was chosen to minimize hydrocarbon contamination. The compressor reservoir was drained of condensed water each morning. A coalescing filter provided water mist and particulate matter removal down to a particle size of one micron. Permeation dryers removed water vapor from the compressor source air. These permeation dryers were followed by moisture indicators to show detectable moisture in the compressor source air. Air was then passed through catalytic oxidizers to destroy any residual hydrocarbons. The oxidizers were followed by one-micron inline filters for secondary particulate matter removal, and a cryogenic trap

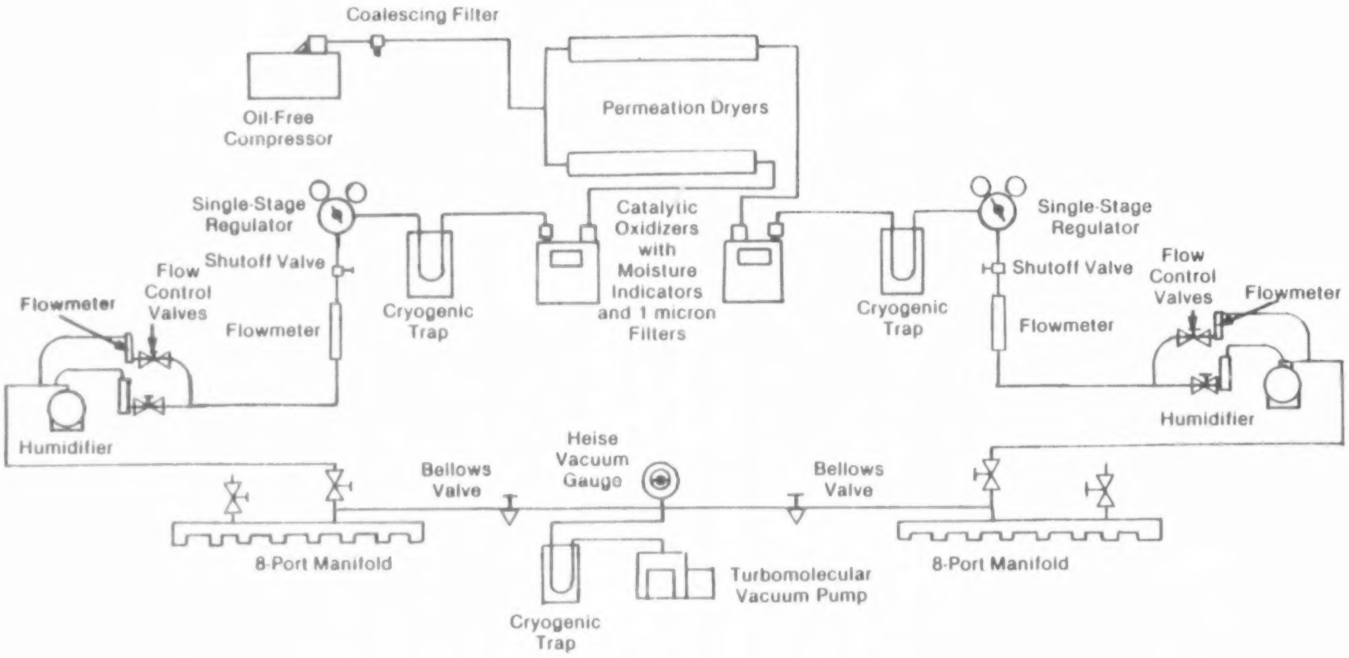
Coalescing Filter
Oil-Free Compressor
Permeation Dryers
Catalytic Oxidizers with Moisture Indicators and 1 micron Filters
Single-Stage Regulator
Shutoff Valve
Flowmeter
Flow Control Valves
Flowmeter
Humidifier
Cryogenic Trap
Cryogenic Trap
Single-Stage Regulator
Shutoff Valve
Flowmeter
Flow Control Valves
Flowmeter
Humidifier
Bellows Valve
Heise Vacuum Gauge
Bellows Valve
8-Port Manifold
Cryogenic Trap
Turbomolecular Vacuum Pump
8-Port Manifold

Figure 3-2. Canister cleanup apparatus.

6870254R

to condense any water formed during oxidation. A single-stage regulator controlled the final air pressure in the canisters and a metering valve was used to control the flowrate at which the canisters were filled during the cleanup cycle. The flow was indicated with a rotameter installed in the clean, dried air line. There was a shutoff valve between the rotameters and the humidifier system. The humidifier system consisted of an electropolished 6-liter canister partially filled with high pressure liquid chromatographic grade (HPLC-grade) water. One flowmeter and flow control valve routed the cleaned, dried air into the 6-liter canister where it was bubbled through the HPLC-grade water. A second flow-control valve and flowmeter allowed air to bypass the canister/bubbler. By setting the flow control valves separately, the downstream relative humidity was regulated. For the 1987 study, Radian used a setting of 1.5 volumes through the humidifier to 12.5 volumes bypassing the humidifier to achieve 15% to 20% relative humidity. There was another shutoff valve between the humidifier and the 8-port manifold where the canisters were connected for cleanup.

The vacuum system consisted of a turbomolecular vacuum pump, a cryogenic trap, an absolute pressure gauge and a bellows valve connected as shown in Figure 3-2. The cryogenic trap prevented the sample canisters from being contaminated by back diffusion of hydrocarbons from the vacuum pump into the cleanup system. There are no oil free high vacuum pumps currently available. The bellows valves enabled isolation of the vacuum pump from the system without shutting off the vacuum pump.

3.3.2 Canister Cleanup Procedure

After NMOC analyses were completed, a bank of eight canisters was connected to each manifold shown in Figure 3-2. The valve on each canister was opened, with the shutoff valves and the bellows valves closed. The vacuum pump was started and one of the bellows valves was opened, drawing a vacuum on the canisters connected to the corresponding manifold. After reaching 5 mm Hg absolute pressure as indicated by the absolute pressure gauge, the vacuum was maintained for 15 minutes on the eight canisters connected to the manifold. The bellows valve was then closed and the cleaned, dried air that had been humidified was introduced into the evacuated canisters until the pressure reached 40 psig. The canisters were filled from the clean air system at the rate of 7.0 L/min. This flowrate was recommended by the manufacturer as the highest flowrate at which the catalytic oxidizers could handle elimination of hydrocarbons with a minimum 99.7% efficiency.

When the first manifold had completed the evacuation phase and was being pressurized, the second manifold was then subjected to vacuum by opening its bellows valve. After 15 minutes, the second manifold was isolated from the vacuum and connected to the clean, dried air that had been humidified. The first manifold of canisters was then taken through a second cycle of evacuation and pressurization. Each manifold bank of eight canisters was subjected to three cleanup cycles.

During the third cleanup cycle, the canisters were pressurized to 40 psig with cleaned, dried air that had not been humidified. For each bank of eight canisters, the canister having the highest precleanup NMOC concentration was selected for NMOC analysis to determine potential hydrocarbon residues. If the analysis measured less than 0.030 ppmC, then the eight canisters on the manifold were considered to be clean. Finally the canisters were again evacuated to 5 mm Hg pressure absolute; they were capped under vacuum and then packed into the containers used for shipping to the field sites.

4.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES AND NMOC DATA ANALYSIS

This section details the steps taken in the 1987 NMOC Project to ensure that the data taken were of known quality and were well documented. Analysis results are given in terms of precision, accuracy, and completeness. Repeated analyses provided analytical precision. Duplicate samples provided sampling and analysis precision. Completeness was measured in terms of percent of scheduled samples that resulted in valid samples, beginning with the first valid site-specific sample collected and ending with the last valid site-specific sample collected. Accuracy of NMOC concentrations was reported as percent bias of audit samples referenced to an NBS SRM propane by EPA-QAD.

4.1 INTRODUCTION

Completeness for the 1987 NMOC study was 95.0%. This value compares to 96.8% completeness for the 1986 study and 95.8% for the 1985 study, and indicates that good communication and planning were maintained between the site personnel and the laboratory personnel. Precision for the 1987 NMOC study averaged 9.61% absolute percent difference of repeated analysis and compared to 9.01% for the 1986 study and 10 percent for the 1985 study. Bias of the Radian channels for the 1987 audit results ranged from -2.9% to -0.06%. In 1986 the accuracy determined from the external audit samples ranged from -0.52% to -3.3%. In 1985 bias ranged from -2.3% to +5.2%.

An initial multipoint performance evaluation was done with propane responses for each Radian channel. Twice daily calibration checks, and daily in-house propane QC samples monitored instrument and operator performance. Duplicate site samples showed good overall sampling and analysis precision as well as sample stability.

Data validation was performed on 10.1% of the NMOC data base, as described later in this section.

4.2 QA/QC DATA

Calibration and drift determinations showed that the instrumentation was stable and that the calibration procedures were consistent. Canister cleanup results showed there was negligible carry-over from one sample to the next. In-house QC samples of propane demonstrated that the analytical systems were in control.

4.2.1 Calibration and Instrument Performance

Initial performance assessments for NMOC were conducted with propane. Daily calibrations were checked with 3.0 ppmC propane for the NMOC measurements.

4.2.1.1 NMOC Performance Results. An initial performance assessment was done on each Radian channel, using propane certified by EPA-QAD. EPA-QAD referenced the certified propane to an NBS SRM No. 1667b propane. The concentration of the propane used in the performance assessment ranged from 0.000 to 6.038 ppmC. The "zero" value was determined using cleaned, dried air from the canister cleanup system described in Section 3.0. Table 4-1 summarizes the performance assessments below. The responses are linear, having coefficients of correlation from 0.999836 to 0.999995. Figures 4-1 through 4-4 show plots of the NMOC performance results for Radian Channels A, B, C, and D, respectively. The plots show the regression line and the boundary lines for the 95 percent confidence interval.

4.2.1.2 Daily NMOC Calibration Zero, Span, and Drift. All Radian channels were spanned twice daily using a mixture of approximately 3.0 ppmC propane-in-air. The propane concentration was certified against an NBS SRM No. 1667b. Daily zero readings were measured using cleaned, dried air, supplied by the clean air system described in Section 3.4.1. The air was dried using a permeation dryer and the hydrocarbon content was destroyed by catalytic oxidation. Particulate was removed from the dried air with sintered stainless steel filters.

Daily calibration and drift data are given in Tables 4-2 through Tables 4-5 for Radian Channels A, B, C, and D, respectively. The data include calibration dates, initial and final zeros and calibration factors, calibration factor drift, and percent calibration factor drift. Initial zero readings and calibration factor determinations were made daily before any site samples were analyzed. Initial and final zero readings indicated NMOC concentrations present in the cleaned, dried air. The maximum initial zero reading was 0.020 ppmC.

TABLE 4-1. PERFORMANCE ASSESSMENT SUMMARY, RADIAN CHANNELS

		Linear Regression Results[a]		
Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	4	-93.326	8715.519	0.999975
B	4	-230.110	8600.559	0.999945
C	4	-226.053	8369.515	0.999836
D	4	57.088	8206.020	0.999995

[a] Figures 4-1 through 4-4 plot propane area counts vs. concentration in ppmC.

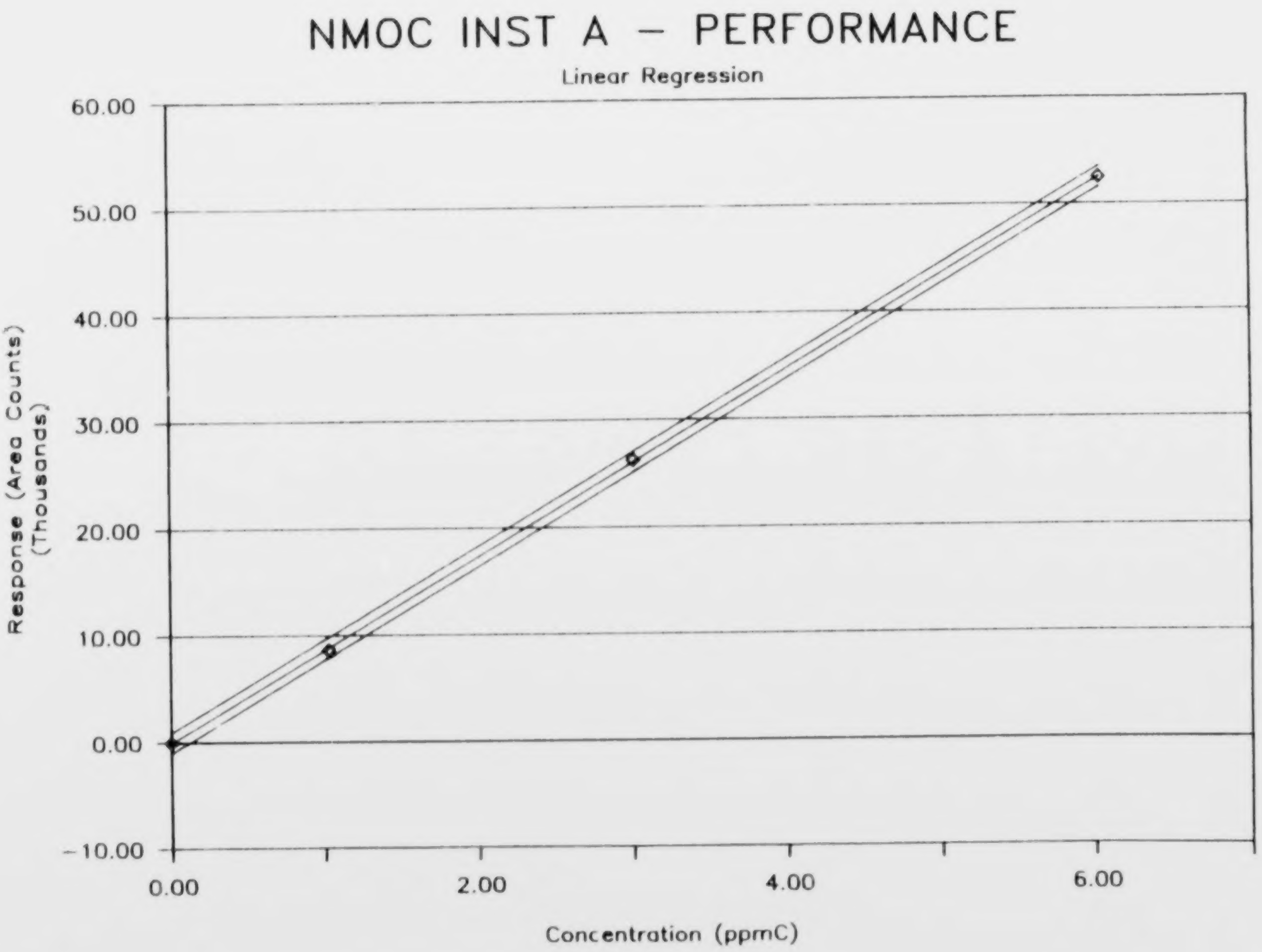

Figure 4-1. NMOC performance results, Channel A.

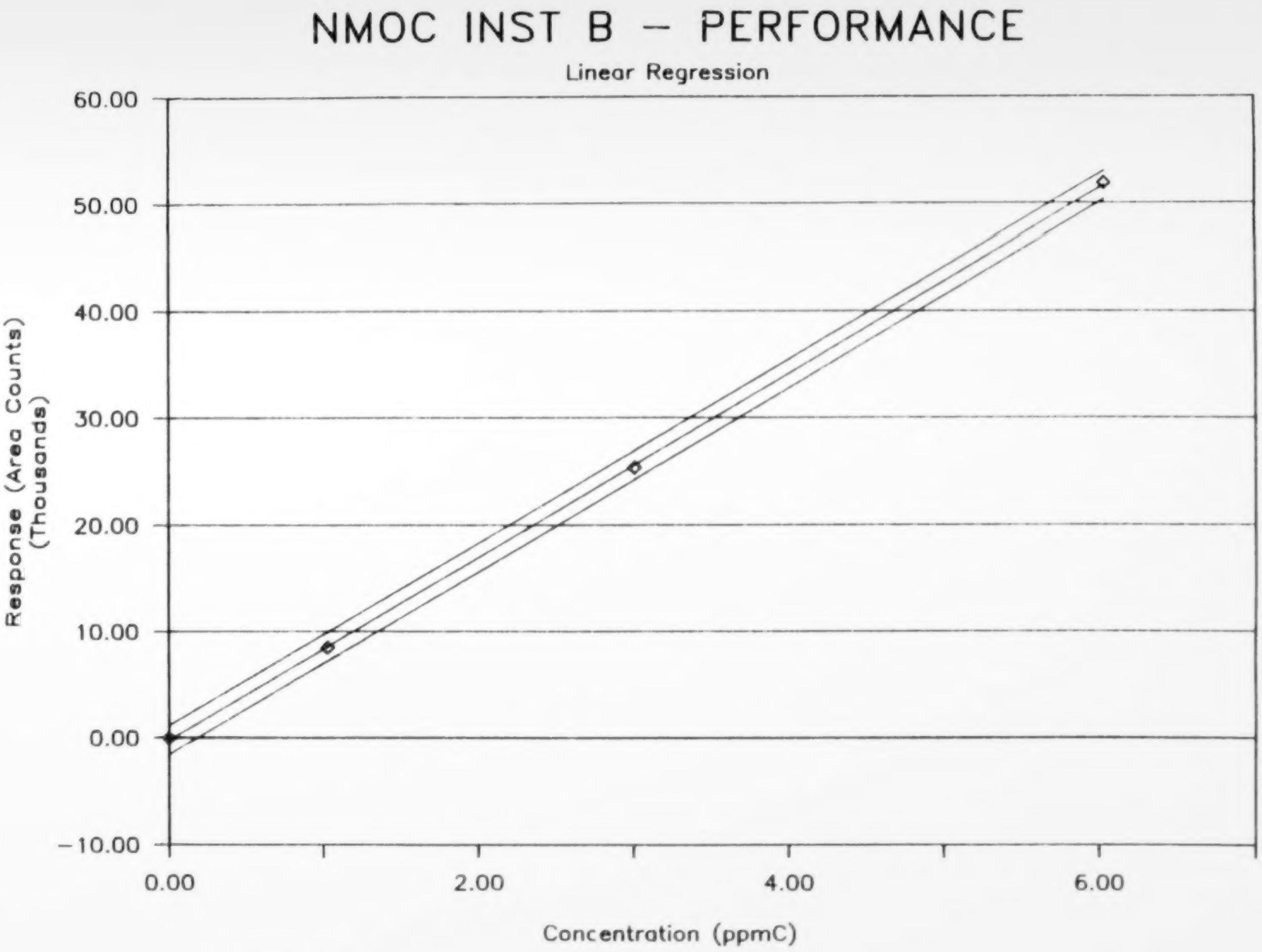

Figure 4-2. NMOC performance results, Channel B.

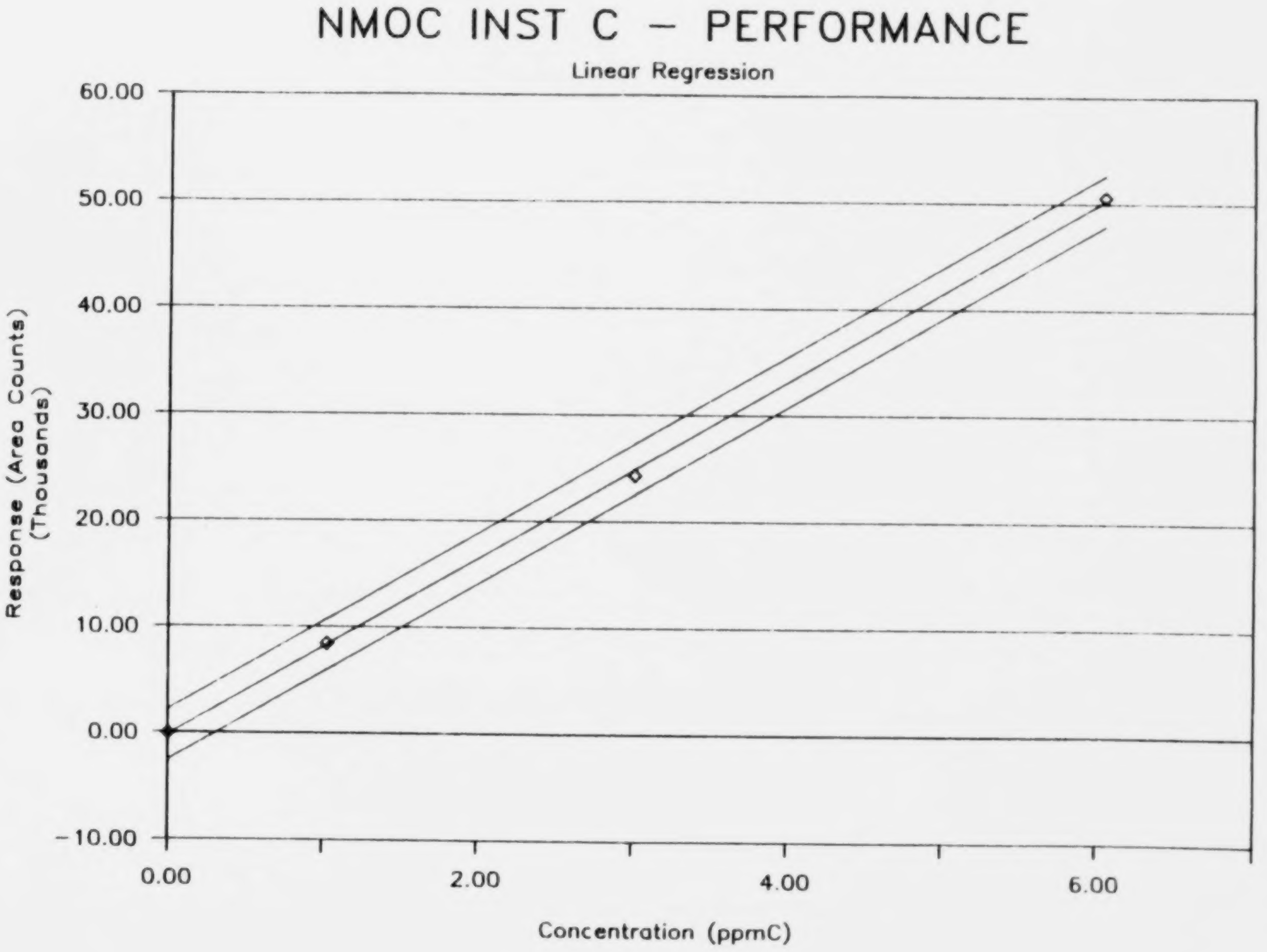

Figure 4-3. NMOC performance results, Channel C.

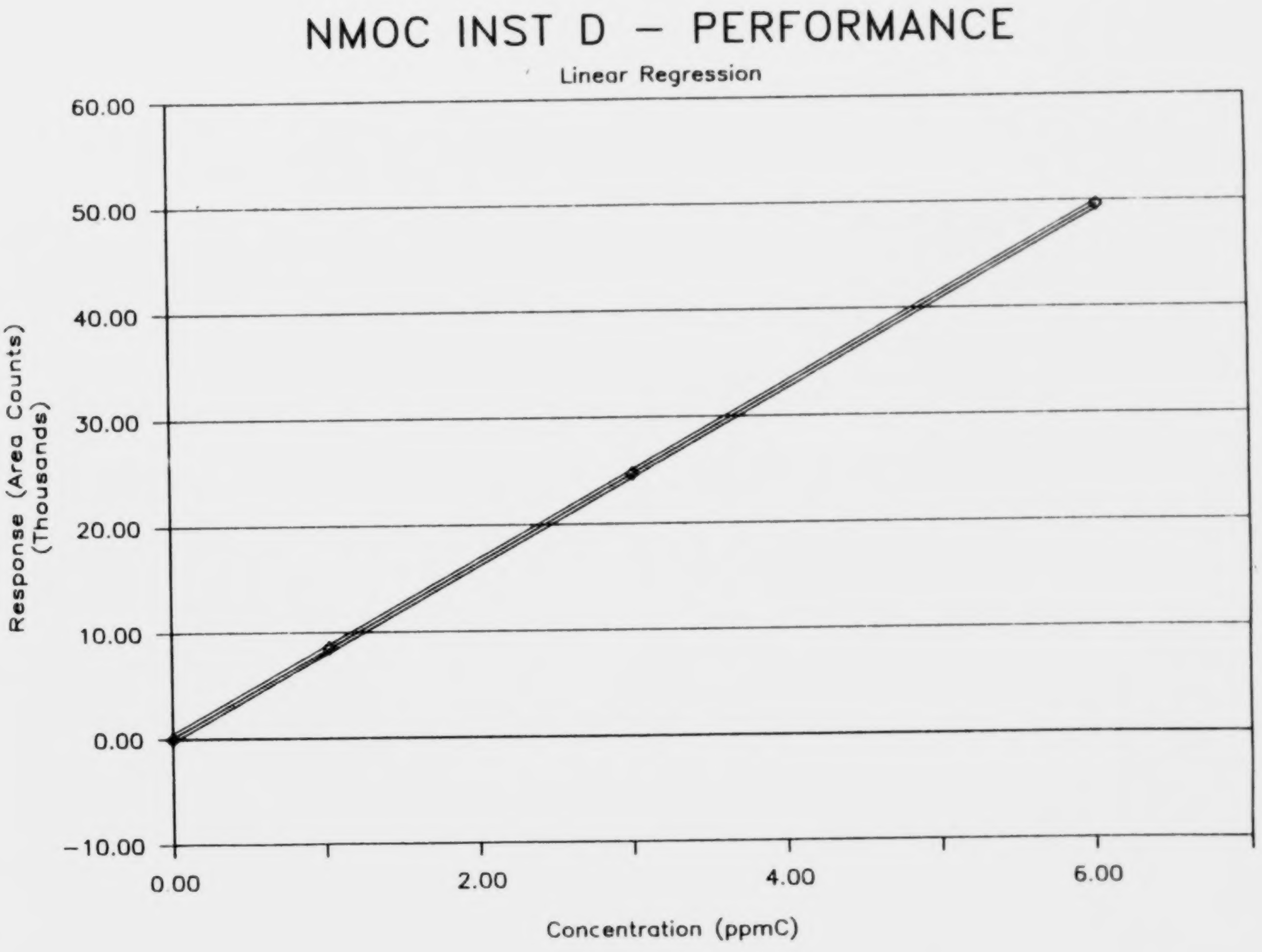

Figure 4-4. NMOC performance results, Channel D.

TABLE 4-2. DAILY CALIBRATION DATA SUMMARY (CHANNEL A)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
04/27/87	117	1.335	1.335	0.0005	0.0005	0.000341	0.000341	0.000000	0.000
05/12/87	132	1.695	1.695	0.0006	0.0006	0.000330	0.000330	0.000000	0.000
05/13/87	133	0.590	0.590	0.0002	0.0002	0.000318	0.000318	0.000000	0.000
05/18/87	138	2.465	2.465	0.0008	0.0008	0.000340	0.000340	0.000000	0.000
05/19/87	139	0.000	0.000	0.0000	0.0000	0.000328	0.000328	0.000000	0.000
05/29/87	149	0.000	0.000	0.0000	0.0000	0.000332	0.000332	0.000000	0.000
06/02/87	153	0.000	1.370	0.0000	0.0004	0.000309	0.000313	0.000004	1.294
06/03/87	154	0.000	0.000	0.0000	0.0000	0.000317	0.000316	-0.000001	-0.315
06/04/87	155	0.000	0.000	0.0000	0.0000	0.000309	0.000314	0.000005	1.618
06/05/87	156	0.000	1.895	0.0000	0.0006	0.000308	0.000314	0.000006	1.948
06/08/87	159	0.000	1.630	0.0000	0.0005	0.000309	0.000325	0.000016	5.178
06/09/87	160	4.925	16.040	0.0015	0.0050	0.000314	0.000310	-0.000004	-1.274
06/10/87	161	0.800	2.405	0.0002	0.0008	0.000312	0.000323	0.000011	3.526
06/11/87	162	0.000	2.945	0.0000	0.0009	0.000308	0.000321	0.000013	4.221
06/12/87	163	0.000	4.675	0.0000	0.0015	0.000314	0.000320	0.000006	1.911
06/15/87	166	2.700	5.030	0.0008	0.0016	0.000310	0.000315	0.000005	1.613
06/16/87	167	0.000	6.245	0.0000	0.0020	0.000310	0.000315	0.000005	1.613
06/17/87	168	0.000	13.715	0.0000	0.0043	0.000307	0.000317	0.000010	3.257
06/18/87	169	0.755	8.980	0.0002	0.0028	0.000314	0.000315	0.000001	0.318
06/19/87	170	0.000	0.000	0.0000	0.0000	0.000306	0.000306	0.000000	0.000
06/22/87	173	2.960	9.915	0.0009	0.0030	0.000302	0.000301	-0.000001	-0.331
06/23/87	174	0.000	26.910	0.0000	0.0083	0.000299	0.000307	0.000008	2.676
06/24/87	175	1.165	6.925	0.0004	0.0022	0.000304	0.000311	0.000007	2.303
06/25/87	176	0.000	13.350	0.0000	0.0041	0.000304	0.000308	0.000004	1.316
06/26/87	177	2.000	1.480	0.0006	0.0004	0.000307	0.000301	-0.000006	-1.954
06/29/87	180	2.040	5.915	0.0006	0.0018	0.000303	0.000307	0.000004	1.320
06/30/87	181	3.355	0.000	0.0010	0.0000	0.000296	0.000309	0.000013	4.392
07/01/87	182	0.000	2.660	0.0000	0.0008	0.000301	0.000303	0.000002	0.664
07/02/87	183	0.830	2.080	0.0003	0.0006	0.000308	0.000310	0.000002	0.649
07/03/87	184	1.525	1.525	0.0000	0.0005	0.000301	0.000301	0.000000	0.000
07/06/87	187	2.500	1.080	0.0007	0.0003	0.000295	0.000303	0.000008	2.712
07/07/87	188	1.170	2.075	0.0004	0.0006	0.000302	0.000305	0.000003	0.993
07/08/87	189	3.580	3.960	0.0011	0.0012	0.000298	0.000305	0.000007	2.349
07/09/87	190	0.000	2.600	0.0000	0.0008	0.000300	0.000307	0.000007	2.333
07/10/87	191	1.295	3.240	0.0004	0.0010	0.000302	0.000307	0.000005	1.656
07/13/87	194	70.460	60.255	0.0211	0.0183	0.000299	0.000303	0.000004	1.338
07/14/87	195	23.345	21.025	0.0070	0.0064	0.000300	0.000303	0.000003	1.000
07/15/87	196	21.010	18.500	0.0065	0.0057	0.000310	0.000306	-0.000004	-1.290
07/16/87	197	19.135	17.895	0.0058	0.0054	0.000303	0.000303	0.000000	0.000
07/17/87	198	16.125	18.840	0.0049	0.0057	0.000305	0.000305	0.000000	0.000
07/20/87	201	22.130	22.130	0.0065	0.0065	0.000295	0.000295	0.000000	0.000
07/21/87	202	16.060	20.745	0.0049	0.0063	0.000305	0.000306	0.000001	0.328
07/22/87	203	24.445	18.610	0.0074	0.0058	0.000302	0.000310	0.000008	2.649

TABLE 4-2. DAILY CALIBRATION DATA SUMMARY (CHANNEL A)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
07/23/87	204	25.025	21.195	0.0076	0.0065	0.000304	0.000309	0.000005	1.645
07/24/87	205	19.150	18.960	0.0057	0.0058	0.000299	0.000306	0.000007	2.341
07/27/87	208	24.070	24.070	0.0073	0.0073	0.000305	0.000305	0.000000	0.000
07/29/87	210	22.450	20.115	0.0068	0.0061	0.000302	0.000302	0.000000	0.000
07/30/87	211	21.070	28.750	0.0064	0.0088	0.000306	0.000306	0.000000	0.000
07/31/87	212	22.340	23.815	0.0069	0.0074	0.000310	0.000309	-0.000001	-0.323
08/03/87	215	25.180	25.180	0.0078	0.0078	0.000308	0.000308	0.000000	0.000
08/04/87	216	28.265	30.040	0.0086	0.0094	0.000306	0.000312	0.000006	1.961
08/05/87	217	27.305	27.680	0.0084	0.0085	0.000307	0.000306	-0.000001	-0.326
08/06/87	218	30.920	31.250	0.0093	0.0097	0.000300	0.000311	0.000011	3.667
08/07/87	219	26.460	29.465	0.0081	0.0091	0.000306	0.000308	0.000002	0.654
08/10/87	222	33.805	31.845	0.0101	0.0099	0.000299	0.000312	0.000013	4.348
08/11/87	223	39.175	32.870	0.0119	0.0101	0.000305	0.000306	0.000001	0.328
08/12/87	224	34.685	34.925	0.0105	0.0108	0.000303	0.000309	0.000006	1.980
08/13/87	225	11.510	8.585	0.0035	0.0027	0.000307	0.000311	0.000004	1.303
08/14/87	226	9.225	10.900	0.0028	0.0034	0.000305	0.000309	0.000004	1.311
08/17/87	229	8.055	9.545	0.0025	0.0030	0.000307	0.000311	0.000004	1.303
08/18/87	230	9.860	9.860	0.0030	0.0030	0.000302	0.000302	0.000000	0.000
08/19/87	231	11.455	9.840	0.0035	0.0030	0.000303	0.000307	0.000004	1.320
08/20/87	232	8.710	9.550	0.0026	0.0029	0.000303	0.000300	-0.000003	-0.990
08/21/87	233	16.735	8.080	0.0050	0.0024	0.000299	0.000303	0.000004	1.338
08/24/87	236	12.680	12.680	0.0037	0.0037	0.000289	0.000289	0.000000	0.000
08/25/87	237	16.770	16.770	0.0049	0.0049	0.000292	0.000292	0.000000	0.000
08/26/87	238	7.860	8.430	0.0023	0.0025	0.000291	0.000298	0.000007	2.405
08/27/87	239	16.040	10.045	0.0047	0.0030	0.000291	0.000297	0.000006	2.062
08/28/87	240	6.520	6.030	0.0019	0.0017	0.000289	0.000289	0.000000	0.000
08/31/87	243	14.825	14.825	0.0043	0.0043	0.000287	0.000287	0.000000	0.000
09/01/87	244	9.150	15.490	0.0027	0.0046	0.000298	0.000295	-0.000003	-1.007
09/02/87	245	11.720	13.790	0.0036	0.0042	0.000303	0.000305	0.000002	0.660
09/03/87	246	13.800	6.900	0.0041	0.0022	0.000295	0.000316	0.000021	7.119
09/04/87	247	10.495	9.560	0.0032	0.0030	0.000304	0.000312	0.000008	2.632
09/08/87	251	0.000	0.000	0.0000	0.0000	0.000310	0.000310	0.000000	0.000
09/09/87	252	0.000	4.290	0.0000	0.0014	0.000330	0.000320	-0.000010	-3.030
09/10/87	253	0.000	4.075	0.0000	0.0013	0.000312	0.000320	0.000008	2.564
09/11/87	254	0.000	1.595	0.0000	0.0005	0.000302	0.000294	-0.000008	-2.649
09/14/87	257	0.000	0.000	0.0000	0.0000	0.000305	0.000317	0.000012	3.934
09/15/87	258	0.000	0.000	0.0000	0.0000	0.000303	0.000320	0.000017	5.611
09/16/87	259	3.210	0.000	0.0010	0.0000	0.000298	0.000309	0.000011	3.691
09/17/87	260	4.390	4.150	0.0014	0.0013	0.000310	0.000314	0.000004	1.290
09/18/87	261	0.715	0.715	0.0002	0.0002	0.000305	0.000305	0.000000	0.000
09/21/87	264	0.470	3.260	0.0001	0.0010	0.000307	0.000320	0.000013	4.235
09/22/87	265	2.710	2.710	0.0008	0.0008	0.000310	0.000310	0.000000	0.000
09/23/87	266	0.000	0.000	0.0000	0.0000	0.000306	0.000314	0.000008	2.614

TABLE 4-2. DAILY CALIBRATION DATA SUMMARY (CHANNEL A)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
09/24/87	267	2.045	1.600	0.0006	0.0005	0.000314	0.000319	0.000005	1.592
09/25/87	268	13.915	1.165	0.0043	0.0004	0.000308	0.000313	0.000005	1.623
09/28/87	271	7.500	7.500	0.0023	0.0023	0.000308	0.000308	0.000000	0.000
09/30/87	273	0.650	1.885	0.0002	0.0006	0.000310	0.000298	-0.000012	-3.871
10/01/87	274	2.875	2.875	0.0009	0.0009	0.000313	0.000313	0.000000	0.000
10/02/87	275	1.735	1.735	0.0005	0.0005	0.000308	0.000308	0.000000	0.000
10/19/87	292	0.000	0.000	0.0000	0.0000	0.000316	0.000316	0.000000	0.000
10/22/87	295	2.565	2.565	0.0008	0.0008	0.000313	0.000313	0.000000	0.000
10/29/87	302	0.000	0.000	0.0000	0.0000	0.000316	0.000316	0.000000	0.000
11/02/87	306	2.175	2.175	0.0007	0.0007	0.000328	0.000328	0.000000	0.000
11/09/87	313	0.000	0.000	0.0000	0.0000	0.000319	0.000319	0.000000	0.000
11/12/87	316	0.000	0.000	0.0000	0.0000	0.000315	0.000315	0.000000	0.000
11/18/87	322	0.000	0.000	0.0000	0.0000	0.000335	0.000335	0.000000	0.000
11/23/87	327	2.570	2.570	0.0009	0.0009	0.000339	0.000339	0.000000	0.000
11/24/87	328	0.000	0.000	0.0000	0.0000	0.000323	0.000323	0.000000	0.000
11/30/87	334	0.585	0.585	0.0002	0.0002	0.000331	0.000331	0.000000	0.000

TABLE 4-3. DAILY CALIBRATION DATA SUMMARY (CHANNEL B)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
04/27/87	117	2.260	2.260	0.0008	0.0008	0.000347	0.000347	0.000000	0.000
05/12/87	132	2.065	2.065	0.0007	0.0007	0.000336	0.000336	0.000000	0.000
05/13/87	133	0.000	0.000	0.0000	0.0000	0.000337	0.000337	0.000000	0.000
05/18/87	138	0.000	0.000	0.0000	0.0000	0.000340	0.000340	0.000000	0.000
05/19/87	139	1.050	1.050	0.0004	0.0004	0.000335	0.000335	0.000000	0.000
05/29/87	149	0.000	0.000	0.0000	0.0000	0.000339	0.000339	0.000000	0.000
06/02/87	153	0.000	1.540	0.0000	0.0005	0.000317	0.000323	0.000006	1.893
06/03/87	154	0.000	5.100	0.0000	0.0016	0.000319	0.000319	0.000000	0.000
06/04/87	155	0.000	5.535	0.0000	0.0018	0.000316	0.000318	0.000002	0.633
06/05/87	156	0.000	4.850	0.0000	0.0015	0.000314	0.000319	0.000005	1.592
06/08/87	159	0.000	6.040	0.0000	0.0019	0.000313	0.000319	0.000006	1.917
06/09/87	160	4.495	87.420	0.0014	0.0281	0.000317	0.000322	0.000005	1.577
06/10/87	161	0.000	2.595	0.0000	0.0008	0.000316	0.000323	0.000007	2.215
06/11/87	162	0.000	1.930	0.0000	0.0006	0.000313	0.000321	0.000008	2.556
06/12/87	163	0.000	7.275	0.0000	0.0023	0.000317	0.000319	0.000002	0.631
06/15/87	166	0.000	0.000	0.0000	0.0000	0.000315	0.000319	0.000004	1.270
06/16/87	167	0.000	4.970	0.0000	0.0016	0.000314	0.000320	0.000006	1.911
06/17/87	168	0.000	18.840	0.0000	0.0060	0.000312	0.000319	0.000007	2.244
06/18/87	169	0.000	11.350	0.0000	0.0036	0.000319	0.000318	-0.000001	-0.313
06/19/87	170	0.000	0.000	0.0000	0.0000	0.000310	0.000310	0.000000	0.000
06/22/87	173	0.890	7.960	0.0003	0.0024	0.000300	0.000307	0.000007	2.333
06/23/87	174	0.000	38.565	0.0000	0.0121	0.000303	0.000315	0.000012	3.960
06/24/87	175	17.735	5.650	0.0055	0.0018	0.000309	0.000312	0.000003	0.971
06/25/87	176	1.160	39.505	0.0004	0.0122	0.000309	0.000310	0.000001	0.324
06/26/87	177	0.000	0.000	0.0000	0.0000	0.000313	0.000307	-0.000006	-1.917
06/29/87	180	0.000	0.000	0.0000	0.0000	0.000305	0.000310	0.000005	1.639
06/30/87	181	0.000	0.000	0.0000	0.0000	0.000300	0.000311	0.000011	3.667
07/01/87	182	0.000	0.000	0.0000	0.0000	0.000303	0.000311	0.000008	2.640
07/02/87	183	0.000	0.000	0.0000	0.0000	0.000311	0.000314	0.000003	0.965
07/03/87	183	1.990	1.990	0.0006	0.0006	0.000305	0.000305	0.000000	0.000
07/06/87	187	0.000	0.000	0.0000	0.0000	0.000299	0.000309	0.000010	3.344
07/07/87	188	0.995	0.000	0.0003	0.0000	0.000315	0.000309	-0.000006	-1.905
07/08/87	189	0.000	1.680	0.0000	0.0005	0.000301	0.000305	0.000004	1.329
07/09/87	190	0.000	1.695	0.0000	0.0005	0.000304	0.000302	-0.000002	-0.658
07/10/87	191	1.595	2.850	0.0005	0.0009	0.000306	0.000307	0.000001	0.327
07/13/87	194	56.700	60.580	0.0173	0.0189	0.000305	0.000312	0.000007	2.295
07/14/87	195	22.175	20.520	0.0068	0.0063	0.000306	0.000307	0.000001	0.327
07/15/87	196	16.825	20.235	0.0052	0.0063	0.000312	0.000310	-0.000002	-0.641
07/16/87	197	13.995	18.495	0.0043	0.0057	0.000307	0.000310	0.000003	0.977
07/17/87	198	16.465	21.380	0.0050	0.0067	0.000306	0.000314	0.000008	2.614
07/20/87	201	19.680	19.680	0.0059	0.0059	0.000299	0.000299	0.000000	0.000
07/21/87	202	24.415	24.460	0.0075	0.0076	0.000308	0.000309	0.000001	0.325
07/22/87	203	18.305	17.460	0.0056	0.0054	0.000304	0.000310	0.000006	1.974

TABLE 4-3. DAILY CALIBRATION DATA SUMMARY (CHANNEL B)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
07/23/87	204	26.180	23.685	0.0080	0.0075	0.000306	0.000316	0.000010	3.268
07/24/87	205	20.990	19.670	0.0064	0.0060	0.000303	0.000304	0.000001	0.330
07/27/87	208	29.440	29.440	0.0091	0.0091	0.000310	0.000310	0.000000	0.000
07/29/87	210	28.420	27.920	0.0086	0.0086	0.000304	0.000308	0.000004	1.316
07/30/87	211	27.580	34.760	0.0085	0.0109	0.000307	0.000314	0.000007	2.280
07/31/87	212	25.740	23.450	0.0079	0.0074	0.000306	0.000314	0.000008	2.614
08/03/87	215	25.410	25.410	0.0080	0.0080	0.000313	0.000313	0.000000	0.000
08/04/87	216	26.615	23.260	0.0083	0.0074	0.000310	0.000317	0.000007	2.258
08/05/87	217	28.130	28.975	0.0087	0.0089	0.000311	0.000308	-0.000003	-0.965
08/06/87	218	28.715	30.690	0.0087	0.0097	0.000303	0.000315	0.000012	3.960
08/07/87	219	27.815	30.230	0.0087	0.0095	0.000311	0.000313	0.000002	0.643
08/10/87	222	35.380	35.680	0.0108	0.0112	0.000306	0.000314	0.000008	2.614
08/11/87	223	31.800	33.935	0.0099	0.0106	0.000312	0.000313	0.000001	0.321
08/12/87	224	37.905	37.995	0.0118	0.0120	0.000311	0.000315	0.000004	1.286
08/13/87	225	9.130	3.585	0.0028	0.0011	0.000311	0.000314	0.000003	0.965
08/14/87	226	9.795	9.195	0.0030	0.0029	0.000310	0.000315	0.000005	1.613
08/17/87	229	11.085	10.665	0.0034	0.0033	0.000311	0.000314	0.000003	0.965
08/18/87	230	7.010	7.010	0.0021	0.0021	0.000305	0.000305	0.000000	0.000
08/19/87	231	11.165	5.505	0.0034	0.0017	0.000307	0.000310	0.000003	0.977
08/20/87	232	5.945	10.490	0.0018	0.0031	0.000305	0.000299	-0.000006	-1.967
08/21/87	233	11.155	8.765	0.0034	0.0027	0.000306	0.000307	0.000001	0.327
08/24/87	236	8.000	8.000	0.0024	0.0024	0.000295	0.000295	0.000000	0.000
08/25/87	237	12.190	12.190	0.0036	0.0036	0.000294	0.000294	0.000000	0.000
08/26/87	238	7.860	15.270	0.0024	0.0046	0.000299	0.000304	0.000005	1.672
08/27/87	239	15.430	11.965	0.0046	0.0036	0.000295	0.000300	0.000005	1.695
08/28/87	240	6.040	8.550	0.0018	0.0025	0.000297	0.000297	0.000000	0.000
08/31/87	243	10.335	10.335	0.0030	0.0030	0.000290	0.000290	0.000000	0.000
09/01/87	244	10.495	14.405	0.0031	0.0043	0.000298	0.000297	-0.000001	-0.336
09/02/87	245	12.540	8.770	0.0039	0.0027	0.000308	0.000305	-0.000003	-0.974
09/03/87	246	9.550	26.800	0.0029	0.0085	0.000299	0.000317	0.000018	6.020
09/04/87	247	11.960	12.040	0.0036	0.0038	0.000305	0.000316	0.000011	3.607
09/08/87	251	0.000	0.000	0.0000	0.0000	0.000320	0.000320	0.000000	0.000
09/09/87	252	0.000	0.000	0.0000	0.0000	0.000320	0.000320	0.000000	0.000
09/10/87	253	0.000	1.980	0.0000	0.0006	0.000312	0.000320	0.000008	2.564
09/11/87	254	0.000	0.000	0.0000	0.0000	0.000316	0.000312	-0.000004	-1.266
09/14/87	257	0.000	0.000	0.0000	0.0000	0.000315	0.000320	0.000005	1.587
09/15/87	258	0.000	0.000	0.0000	0.0000	0.000318	0.000324	0.000006	1.887
09/16/87	259	0.000	20.150	0.0000	0.0063	0.000320	0.000312	-0.000008	-2.500
09/17/87	260	7.080	3.730	0.0022	0.0012	0.000310	0.000315	0.000005	1.613
09/18/87	261	0.000	0.000	0.0000	0.0000	0.000311	0.000311	0.000000	0.000
09/21/87	264	0.000	0.000	0.0000	0.0000	0.000312	0.000320	0.000008	2.564
09/22/87	265	0.000	0.000	0.0000	0.0000	0.000313	0.000313	0.000000	0.000
09/23/87	266	0.000	0.000	0.0000	0.0000	0.000313	0.000319	0.000006	1.917

TABLE 4-3. DAILY CALIBRATION DATA SUMMARY (CHANNEL B)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
09/24/87	267	0.000	0.000	0.0000	0.0000	0.000315	0.000320	0.000005	1.587
09/25/87	268	8.775	0.000	0.0028	0.0000	0.000316	0.000318	0.000002	0.633
09/28/87	271	6.250	6.250	0.0020	0.0020	0.000314	0.000314	0.000000	0.000
09/30/87	273	2.600	3.180	0.0008	0.0010	0.000316	0.000319	0.000003	0.949
10/01/87	274	0.000	0.000	0.0000	0.0000	0.000314	0.000314	0.000000	0.000
10/02/87	275	7.000	7.000	0.0022	0.0022	0.000314	0.000314	0.000000	0.000
10/19/87	292	1.895	1.895	0.0006	0.0006	0.000322	0.000322	0.000000	0.000
10/22/87	295	1.150	1.150	0.0004	0.0004	0.000320	0.000320	0.000000	0.000
10/29/87	302	0.000	0.000	0.0000	0.0000	0.000323	0.000323	0.000000	0.000
11/02/87	306	1.095	1.095	0.0004	0.0004	0.000326	0.000326	0.000000	0.000
11/09/87	313	0.000	0.000	0.0000	0.0000	0.000324	0.000324	0.000000	0.000
11/12/87	316	0.000	0.000	0.0000	0.0000	0.000325	0.000325	0.000000	0.000
11/18/87	322	0.000	0.000	0.0000	0.0000	0.000343	0.000343	0.000000	0.000
11/23/87	327	1.155	1.155	0.0004	0.0004	0.000344	0.000344	0.000000	0.000
11/24/87	328	0.000	0.000	0.0000	0.0000	0.000331	0.000331	0.000000	0.000
11/30/87	334	0.000	0.000	0.0000	0.0000	0.000335	0.000335	0.000000	0.000

TABLE 4-4. DAILY CALIBRATION DATA SUMMARY (CHANNEL C)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
04/27/87	117	0.000	0.000	0.0000	0.0000	0.000344	0.000344	0.000000	0.000
05/12/87	132	0.000	0.000	0.0000	0.0000	0.000347	0.000347	0.000000	0.000
05/13/87	133	0.000	0.000	0.0000	0.0000	0.000346	0.000346	0.000000	0.000
05/18/87	138	0.000	0.000	0.0000	0.0000	0.000344	0.000344	0.000000	0.000
05/19/87	139	0.000	0.000	0.0000	0.0000	0.000342	0.000342	0.000000	0.000
05/29/87	149	0.000	0.000	0.0000	0.0000	0.000345	0.000345	0.000000	0.000
06/02/87	153	0.000	0.000	0.0000	0.0000	0.000324	0.000325	0.000001	0.309
06/03/87	154	0.000	2.570	0.0000	0.0009	0.000321	0.000331	0.000010	3.115
06/04/87	155	0.000	0.000	0.0000	0.0000	0.000327	0.000326	-0.000001	-0.306
06/05/87	156	0.000	0.000	0.0000	0.0000	0.000329	0.000315	-0.000014	-4.255
06/08/87	159	0.000	0.000	0.0000	0.0000	0.000320	0.000339	0.000019	5.937
06/09/87	160	0.000	24.555	0.0000	0.0083	0.000329	0.000336	0.000007	2.128
06/10/87	161	3.250	0.000	0.0010	0.0000	0.000323	0.000335	0.000012	3.715
06/11/87	162	0.000	34.435	0.0000	0.0115	0.000329	0.000333	0.000004	1.216
06/12/87	163	0.000	45.195	0.0000	0.0151	0.000323	0.000335	0.000012	3.715
06/15/87	166	0.000	0.000	0.0000	0.0000	0.000322	0.000330	0.000008	2.484
06/16/87	167	0.000	1.060	0.0000	0.0003	0.000322	0.000328	0.000006	1.863
06/17/87	168	0.000	0.000	0.0000	0.0000	0.000305	0.000328	0.000023	7.541
06/18/87	169	0.000	3.325	0.0000	0.0011	0.000322	0.000328	0.000006	1.863
06/19/87	170	0.000	0.000	0.0000	0.0000	0.000317	0.000317	0.000000	0.000
06/22/87	173	0.000	6.845	0.0000	0.0022	0.000311	0.000319	0.000008	2.572
06/23/87	174	0.000	43.080	0.0000	0.0137	0.000319	0.000318	-0.000001	-0.313
06/24/87	175	0.000	5.780	0.0000	0.0018	0.000316	0.000320	0.000004	1.266
06/25/87	176	0.000	9.050	0.0000	0.0029	0.000316	0.000318	0.000002	0.633
06/26/87	177	0.000	0.000	0.0000	0.0000	0.000313	0.000317	0.000004	1.278
06/29/87	180	2.615	0.000	0.0008	0.0000	0.000315	0.000316	0.000001	0.317
06/30/87	181	0.000	4.135	0.0000	0.0013	0.000319	0.000315	-0.000004	-1.254
07/01/87	182	0.000	0.000	0.0000	0.0000	0.000309	0.000313	0.000004	1.294
07/02/87	183	0.000	1.855	0.0000	0.0006	0.000314	0.000318	0.000004	1.274
07/03/87	184	0.000	0.000	0.0000	0.0000	0.000319	0.000319	0.000000	0.000
07/06/87	187	1.215	0.000	0.0004	0.0000	0.000310	0.000318	0.000008	2.581
07/07/87	188	0.000	0.000	0.0000	0.0000	0.000314	0.000312	-0.000002	-0.637
07/08/87	189	0.000	1.500	0.0000	0.0005	0.000306	0.000318	0.000012	3.922
07/09/87	190	0.000	0.000	0.0000	0.0000	0.000312	0.000312	0.000000	0.000
07/10/87	191	0.000	0.000	0.0000	0.0000	0.000308	0.000313	0.000005	1.623
07/13/87	194	69.455	62.745	0.0216	0.0193	0.000311	0.000307	-0.000004	-1.286
07/14/87	195	17.815	17.320	0.0056	0.0054	0.000314	0.000312	-0.000002	-0.637
07/15/87	196	14.500	17.665	0.0047	0.0056	0.000322	0.000317	-0.000005	-1.553
07/16/87	197	13.065	16.405	0.0041	0.0051	0.000310	0.000313	0.000003	0.968
07/17/87	198	19.070	18.985	0.0059	0.0061	0.000310	0.000320	0.000010	3.226
07/20/87	201	15.975	95.975	0.0051	0.0304	0.000317	0.000317	0.000000	0.000
07/21/87	202	21.905	18.200	0.0067	0.0058	0.000304	0.000321	0.000017	5.592
07/22/87	203	18.990	18.685	0.0060	0.0061	0.000316	0.000324	0.000008	2.532

TABLE 4-4. DAILY CALIBRATION DATA SUMMARY (CHANNEL C)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
07/23/87	204	19.245	30.815	0.0061	0.0100	0.000315	0.000324	0.000009	2.857
07/24/87	205	22.265	19.480	0.0070	0.0060	0.000315	0.000309	-0.000006	-1.905
07/27/87	208	19.840	19.840	0.0062	0.0062	0.000315	0.000315	0.000000	0.000
07/28/87	209	18.780	22.670	0.0059	0.0072	0.000315	0.000319	0.000004	1.270
07/29/87	210	19.635	20.420	0.0062	0.0065	0.000318	0.000316	-0.000002	-0.629
07/30/87	211	21.805	24.290	0.0069	0.0077	0.000318	0.000319	0.000001	0.314
07/31/87	212	22.670	21.175	0.0072	0.0068	0.000318	0.000320	0.000002	0.629
08/03/87	215	24.220	24.220	0.0076	0.0076	0.000313	0.000313	0.000000	0.000
08/04/87	216	25.650	26.790	0.0082	0.0086	0.000318	0.000320	0.000002	0.629
08/05/87	217	27.960	27.695	0.0086	0.0089	0.000306	0.000321	0.000015	4.902
08/06/87	218	28.300	24.060	0.0090	0.0077	0.000317	0.000318	0.000001	0.315
08/07/87	219	29.640	25.645	0.0092	0.0082	0.000309	0.000321	0.000012	3.883
08/10/87	222	31.210	33.325	0.0101	0.0109	0.000324	0.000327	0.000003	0.926
08/11/87	223	34.270	32.630	0.0109	0.0103	0.000319	0.000317	-0.000002	-0.627
08/12/87	224	37.510	37.705	0.0121	0.0129	0.000322	0.000341	0.000019	5.901
08/13/87	225	7.480	6.590	0.0024	0.0021	0.000322	0.000325	0.000003	0.932
08/14/87	226	5.725	5.045	0.0018	0.0016	0.000320	0.000326	0.000006	1.875
08/17/87	229	2.790	3.730	0.0009	0.0012	0.000319	0.000326	0.000007	2.194
08/18/87	230	5.165	5.165	0.0016	0.0016	0.000316	0.000316	0.000000	0.000
08/19/87	231	6.480	11.130	0.0021	0.0035	0.000319	0.000317	-0.000002	-0.627
08/20/87	232	12.960	9.940	0.0041	0.0031	0.000313	0.000315	0.000002	0.639
08/21/87	233	11.970	8.375	0.0038	0.0026	0.000321	0.000313	-0.000008	-2.492
08/24/87	236	8.800	8.800	0.0026	0.0026	0.000299	0.000299	0.000000	0.000
08/26/87	238	11.225	8.445	0.0035	0.0026	0.000310	0.000311	0.000001	0.323
08/27/87	239	12.465	8.275	0.0039	0.0026	0.000309	0.000315	0.000006	1.942
08/28/87	240	9.580	14.425	0.0030	0.0045	0.000309	0.000310	0.000001	0.324
08/31/87	243	7.875	7.875	0.0024	0.0024	0.000310	0.000310	0.000000	0.000
09/01/87	244	7.175	5.675	0.0022	0.0018	0.000303	0.000313	0.000010	3.300
09/02/87	245	7.220	5.480	0.0023	0.0017	0.000312	0.000311	-0.000001	-0.321
09/03/87	246	3.480	23.315	0.0011	0.0074	0.000313	0.000318	0.000005	1.597
09/04/87	247	4.090	5.190	0.0013	0.0016	0.000318	0.000315	-0.000003	-0.943
09/08/87	251	0.000	0.000	0.0000	0.0000	0.000326	0.000326	0.000000	0.000
09/09/87	252	0.000	0.000	0.0000	0.0000	0.000330	0.000333	0.000003	0.909
09/10/87	253	0.000	3.875	0.0000	0.0013	0.000340	0.000340	0.000000	0.000
09/11/87	254	0.000	1.360	0.0000	0.0005	0.000314	0.000336	0.000022	7.006
09/14/87	257	0.000	0.000	0.0000	0.0000	0.000332	0.000334	0.000002	0.602
09/15/87	258	0.000	0.000	0.0000	0.0000	0.000328	0.000324	-0.000004	-1.220
09/16/87	259	0.000	0.000	0.0000	0.0000	0.000317	0.000332	0.000015	4.732
09/17/87	260	0.000	2.515	0.0000	0.0008	0.000321	0.000322	0.000001	0.312
09/18/87	261	0.000	0.000	0.0000	0.0000	0.000330	0.000330	0.000000	0.000
09/21/87	264	0.000	0.000	0.0000	0.0000	0.000330	0.000340	0.000010	3.030
09/22/87	265	0.000	0.000	0.0000	0.0000	0.000318	0.000318	0.000000	0.000
09/23/87	266	0.000	21.580	0.0000	0.0071	0.000330	0.000330	0.000000	0.000

TABLE 4-4. DAILY CALIBRATION DATA SUMMARY (CHANNEL C)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
09/24/87	267	0.000	1.585	0.0000	0.0005	0.000325	0.000336	0.000011	3.385
09/25/87	268	3.300	0.000	0.0011	0.0000	0.000326	0.000324	-0.000002	-0.613
09/28/87	271	2.170	2.170	0.0007	0.0007	0.000324	0.000324	0.000000	0.000
09/29/87	272	0.000	6.625	0.0000	0.0022	0.000329	0.000327	-0.000002	-0.608
09/30/87	273	5.155	10.590	0.0017	0.0035	0.000327	0.000329	0.000002	0.612
10/01/87	274	0.000	0.000	0.0000	0.0000	0.000328	0.000328	0.000000	0.000
10/02/87	275	0.000	0.000	0.0000	0.0000	0.000324	0.000324	0.000000	0.000
10/05/87	278	0.000	0.000	0.0000	0.0000	0.000325	0.000332	0.000007	2.154
10/07/87	280	0.000	0.000	0.0000	0.0000	0.000332	0.000332	0.000000	0.000
10/12/87	285	0.000	0.000	0.0000	0.0000	0.000331	0.000331	0.000000	0.000
10/14/87	287	0.000	0.000	0.0000	0.0000	0.000330	0.000330	0.000000	0.000
10/19/87	292	0.000	0.000	0.0000	0.0000	0.000331	0.000331	0.000000	0.000
10/26/87	299	0.000	0.000	0.0000	0.0000	0.000324	0.000324	0.000000	0.000
10/30/87	303	0.000	0.000	0.0000	0.0000	0.000336	0.000336	0.000000	0.000
11/04/87	308	6.515	6.515	0.0022	0.0022	0.000332	0.000332	0.000000	0.000
11/10/87	314	0.000	0.000	0.0000	0.0000	0.000323	0.000323	0.000000	0.000
11/13/87	317	0.000	0.000	0.0000	0.0000	0.000357	0.000357	0.000000	0.000
11/23/87	327	0.000	0.000	0.0000	0.0000	0.000349	0.000349	0.000000	0.000
11/24/87	328	0.000	0.000	0.0000	0.0000	0.000340	0.000340	0.000000	0.000
11/25/87	329	0.000	0.000	0.0000	0.0000	0.000353	0.000353	0.000000	0.000

TABLE 4-5. DAILY CALIBRATION DATA SUMMARY (CHANNEL D)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
04/27/87	117	0.865	0.865	0.0003	0.0003	0.000327	0.000327	0.000000	0.000
05/12/87	132	0.000	0.000	0.0000	0.0000	0.000335	0.000335	0.000000	0.000
05/13/87	133	0.000	0.000	0.0000	0.0000	0.000335	0.000335	0.000000	0.000
05/18/87	138	0.000	0.000	0.0000	0.0000	0.000344	0.000344	0.000000	0.000
05/19/87	139	0.000	0.000	0.0000	0.0000	0.000331	0.000331	0.000000	0.000
05/29/87	149	0.000	0.000	0.0000	0.0000	0.000331	0.000331	0.000000	0.000
06/02/87	153	0.000	0.000	0.0000	0.0000	0.000313	0.000311	-0.000002	-0.639
06/03/87	154	0.000	0.000	0.0000	0.0000	0.000313	0.000318	0.000005	1.597
06/04/87	155	0.000	0.000	0.0000	0.0000	0.000317	0.000315	-0.000002	-0.631
06/05/87	156	0.000	0.000	0.0000	0.0000	0.000322	0.000326	0.000004	1.242
06/08/87	159	0.000	0.000	0.0000	0.0000	0.000311	0.000315	0.000004	1.286
06/09/87	160	0.000	0.000	0.0000	0.0000	0.000323	0.000317	-0.000006	-1.858
06/10/87	161	0.000	1.835	0.0000	0.0006	0.000312	0.000327	0.000015	4.808
06/11/87	162	0.000	21.940	0.0000	0.0071	0.000321	0.000324	0.000003	0.935
06/12/87	163	0.000	5.045	0.0000	0.0016	0.000317	0.000326	0.000009	2.839
06/15/87	166	0.905	0.000	0.0003	0.0000	0.000317	0.000329	0.000012	3.785
06/16/87	167	0.000	7.280	0.0000	0.0024	0.000318	0.000327	0.000009	2.830
06/17/87	168	0.000	9.925	0.0000	0.0032	0.000315	0.000326	0.000011	3.492
06/18/87	169	0.000	5.735	0.0000	0.0019	0.000313	0.000326	0.000013	4.153
06/19/87	170	0.000	0.000	0.0000	0.0000	0.000316	0.000316	0.000000	0.000
06/22/87	173	1.140	8.925	0.0003	0.0028	0.000305	0.000309	0.000004	1.311
06/23/87	174	0.000	74.855	0.0000	0.0243	0.000320	0.000325	0.000005	1.562
06/24/87	175	0.000	12.735	0.0000	0.0041	0.000312	0.000324	0.000012	3.846
06/25/87	176	0.000	30.975	0.0000	0.0099	0.000311	0.000320	0.000009	2.894
06/26/87	177	0.000	0.525	0.0000	0.0002	0.000311	0.000297	-0.000014	-4.502
06/29/87	180	0.000	14.565	0.0000	0.0046	0.000312	0.000315	0.000003	0.962
06/30/87	181	0.000	5.925	0.0000	0.0019	0.000319	0.000314	-0.000005	-1.567
07/01/87	182	0.000	4.150	0.0000	0.0013	0.000304	0.000310	0.000006	1.974
07/02/87	183	0.000	3.025	0.0000	0.0009	0.000307	0.000309	0.000002	0.651
07/03/87	184	0.000	0.000	0.0000	0.0000	0.000317	0.000317	0.000000	0.000
07/06/87	187	1.650	2.230	0.0005	0.0007	0.000307	0.000321	0.000014	4.560
07/07/87	188	0.675	2.430	0.0002	0.0007	0.000313	0.000305	-0.000008	-2.556
07/08/87	189	0.000	4.945	0.0000	0.0016	0.000318	0.000316	-0.000002	-0.629
07/09/87	190	0.000	3.380	0.0000	0.0011	0.000307	0.000327	0.000020	6.515
07/10/87	191	0.000	0.600	0.0000	0.0002	0.000308	0.000315	0.000007	2.273
07/13/87	194	58.360	75.825	0.0178	0.0222	0.000305	0.000293	-0.000012	-3.934
07/14/87	195	20.510	15.850	0.0065	0.0051	0.000316	0.000322	0.000006	1.899
07/15/87	196	13.005	19.240	0.0043	0.0061	0.000330	0.000315	-0.000015	-4.545
07/16/87	197	11.250	15.485	0.0034	0.0048	0.000304	0.000313	0.000009	2.961
07/17/87	198	22.955	20.235	0.0073	0.0065	0.000318	0.000322	0.000004	1.258
07/20/87	201	16.440	16.440	0.0052	0.0052	0.000318	0.000318	0.000000	0.000
07/21/87	202	31.385	20.485	0.0095	0.0066	0.000303	0.000322	0.000019	6.271
07/22/87	203	16.240	21.920	0.0051	0.0070	0.000317	0.000318	0.000001	0.315

TABLE 4-5. DAILY CALIBRATION DATA SUMMARY (CHANNEL D)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
07/23/87	204	22.025	28.655	0.0069	0.0092	0.000313	0.000321	0.000008	2.556
07/24/87	205	19.305	20.970	0.0061	0.0062	0.000314	0.000296	-0.000018	-5.732
07/27/87	208	22.560	22.560	0.0072	0.0072	0.000317	0.000317	0.000000	0.000
07/28/87	209	25.340	16.490	0.0081	0.0053	0.000318	0.000321	0.000003	0.943
07/29/87	210	22.510	27.475	0.0071	0.0088	0.000315	0.000321	0.000006	1.905
07/30/87	211	25.845	32.295	0.0082	0.0104	0.000319	0.000321	0.000002	0.627
07/31/87	212	22.590	17.650	0.0072	0.0057	0.000317	0.000321	0.000004	1.262
08/03/87	215	26.215	26.215	0.0079	0.0079	0.000303	0.000303	0.000000	0.000
08/04/87	216	25.880	20.980	0.0083	0.0068	0.000319	0.000323	0.000004	1.254
08/05/87	217	29.050	29.000	0.0087	0.0094	0.000300	0.000323	0.000023	7.667
08/06/87	218	29.760	22.045	0.0096	0.0071	0.000321	0.000320	-0.000001	-0.312
08/07/87	219	25.020	24.405	0.0077	0.0078	0.000307	0.000318	0.000011	3.583
08/10/87	222	39.010	29.685	0.0128	0.0094	0.000328	0.000317	-0.000011	-3.354
08/11/87	223	31.220	38.180	0.0100	0.0126	0.000321	0.000330	0.000009	2.804
08/12/87	224	38.455	35.315	0.0125	0.0116	0.000324	0.000328	0.000004	1.235
08/13/87	225	6.555	6.705	0.0021	0.0022	0.000325	0.000329	0.000004	1.231
08/14/87	226	6.375	8.490	0.0021	0.0028	0.000322	0.000330	0.000008	2.484
08/17/87	229	5.940	6.330	0.0019	0.0021	0.000320	0.000330	0.000010	3.125
08/18/87	230	10.380	10.380	0.0032	0.0032	0.000305	0.000305	0.000000	0.000
08/19/87	231	6.425	7.130	0.0020	0.0023	0.000310	0.000319	0.000009	2.903
08/20/87	232	8.090	6.600	0.0026	0.0021	0.000322	0.000316	-0.000006	-1.863
08/21/87	233	8.375	9.360	0.0027	0.0030	0.000325	0.000322	-0.000003	-0.923
08/24/87	236	6.870	6.870	0.0020	0.0020	0.000290	0.000290	0.000000	0.000
08/26/87	238	6.575	8.610	0.0019	0.0027	0.000294	0.000308	0.000014	4.762
08/27/87	239	10.030	0.000	0.0031	0.0000	0.000306	0.000314	0.000008	2.614
08/28/87	240	0.000	0.000	0.0000	0.0000	0.000314	0.000314	0.000000	0.000
08/31/87	243	9.525	9.525	0.0030	0.0030	0.000315	0.000315	0.000000	0.000
09/01/87	244	9.555	7.425	0.0029	0.0024	0.000302	0.000320	0.000018	5.960
09/02/87	245	28.685	21.300	0.0088	0.0065	0.000306	0.000306	0.000000	0.000
09/03/87	246	44.745	57.880	0.0146	0.0191	0.000326	0.000330	0.000004	1.227
09/04/87	247	6.290	6.000	0.0021	0.0020	0.000329	0.000326	-0.000003	-0.912
09/08/87	251	0.000	0.000	0.0000	0.0000	0.000336	0.000336	0.000000	0.000
09/09/87	252	0.000	0.000	0.0000	0.0000	0.000342	0.000341	-0.000001	-0.292
09/10/87	253	0.000	0.000	0.0000	0.0000	0.000340	0.000340	0.000000	0.000
09/11/87	254	0.000	0.000	0.0000	0.0000	0.000312	0.000306	-0.000006	-1.923
09/14/87	257	0.000	0.000	0.0000	0.0000	0.000328	0.000339	0.000011	3.354
09/15/87	258	0.000	0.000	0.0000	0.0000	0.000330	0.000336	0.000006	1.818
09/16/87	259	0.000	0.000	0.0000	0.0000	0.000327	0.000343	0.000016	4.893
09/17/87	260	0.000	1.705	0.0000	0.0006	0.000330	0.000332	0.000002	0.606
09/18/87	261	0.000	0.000	0.0000	0.0000	0.000340	0.000340	0.000000	0.000
09/21/87	264	0.000	0.000	0.0000	0.0000	0.000330	0.000330	0.000000	0.000
09/22/87	265	0.000	0.000	0.0000	0.0000	0.000323	0.000323	0.000000	0.000
09/23/87	266	0.000	10.730	0.0000	0.0035	0.000330	0.000330	0.000000	0.000

TABLE 4-5. DAILY CALIBRATION DATA SUMMARY (CHANNEL D)

Calib. Date	Julian Calib. Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal. Factor	Final Cal. Factor	(Drift) Cal. Factor	(% Drift) Cal. Factor
09/24/87	267	0.000	0.000	0.0000	0.0000	0.000336	0.000342	0.000006	1.786
09/25/87	268	1.005	1.905	0.0003	0.0006	0.000337	0.000333	-0.000004	-1.187
09/28/87	271	3.415	3.415	0.0011	0.0011	0.000333	0.000333	0.000000	0.000
09/29/87	272	0.000	1.105	0.0000	0.0004	0.000340	0.000335	-0.000005	-1.471
09/30/87	273	4.170	1.230	0.0014	0.0004	0.000329	0.000340	0.000011	3.343
10/01/87	274	0.000	0.000	0.0000	0.0000	0.000336	0.000336	0.000000	0.000
10/02/87	275	0.000	0.000	0.0000	0.0000	0.000326	0.000326	0.000000	0.000
10/05/87	278	7.940	0.000	0.0026	0.0000	0.000329	0.000340	0.000011	3.343
10/07/87	280	0.000	0.000	0.0000	0.0000	0.000340	0.000340	0.000000	0.000
10/12/87	285	0.000	0.000	0.0000	0.0000	0.000339	0.000339	0.000000	0.000
10/14/87	287	0.365	0.365	0.0001	0.0001	0.000326	0.000326	0.000000	0.000
10/19/87	292	0.000	0.000	0.0000	0.0000	0.000340	0.000340	0.000000	0.000
10/26/87	299	0.000	0.000	0.0000	0.0000	0.000328	0.000328	0.000000	0.000
10/30/87	303	0.110	0.110	0.0000	0.0000	0.000343	0.000343	0.000000	0.000
11/04/87	308	5.840	5.840	0.0020	0.0020	0.000345	0.000345	0.000000	0.000
11/10/87	314	0.000	0.000	0.0000	0.0000	0.000308	0.000308	0.000000	0.000
11/13/87	317	0.555	0.555	0.0002	0.0002	0.000355	0.000355	0.000000	0.000
11/23/87	327	0.000	0.000	0.0000	0.0000	0.000352	0.000352	0.000000	0.000
11/24/87	328	0.000	0.000	0.0000	0.0000	0.000335	0.000335	0.000000	0.000
11/25/87	329	0.000	0.000	0.0000	0.0000	0.000358	0.000358	0.000000	0.000

Final calibration factors were determined at the end of each day after all the site samples had been analyzed. Calibration factor drift was defined as final calibration factor minus initial calibration factor. Percent calibration factor drift was defined as the calibration factor drift divided by the initial calibration factor, expressed as a percentage.

Figures 4-5 through 4-8 show the daily calibration zeros; Figures 4-9 through 4-12 show the daily calibration spans; and Figures 4-13 through 4-16 show the daily percent calibration factor drifts for Radian Channels A, B, C, and D, respectively.

4.2.1.3 NMOC Calibration Drift. Summary calibration factor drift data are given in Table 4-6. The table presents calibration factor drift, percent calibration factor drift, and absolute percent calibration factor drift. Calibration factors were calculated from an analysis of a propane-air mixture whose concentration was known and was referenced by the EPA-QAD to an NBS SRM No. 1667b, propane reference standard as follows:

$$\text{calibration factor} = \frac{\text{concentration of propane standard (ppm)} \times 3\ \text{ppmC/ppm}}{(\text{propane standard response (area counts)} - \text{zero response (area counts)})}$$

Daily calibration factors ranged from 0.000287 ppmC/area count to 0.000347 ppmC/area count, depending on the channel. Maxima, minima, and mean values are given for calibration factor drift and percent calibration factor drift. If drift and percent drift are random variables and normally distributed, the mean values would be expected to be zero. The means shown in Table 4-6 for the drift and percent drift are approximately zero, showing little bias overall, or for any channel. The overall mean values shown in Table 4-6 were weighted according to the number of calibration drift data for each channel. The last two columns of Table 4-6 show the means and standard deviations of the absolute percent calibration factor drifts. The fact that the standard deviations are the same order of magnitude as the means indicates that the mean calibration factor drifts are not significantly different from zero.

The absolute percent calibration factor drift is a measure of the calibration drift variability and averages 1.44 percent overall. The mean absolute percent calibration drift ranges from 1.21 percent for Radian Channel B to 1.71 percent for Channel D.

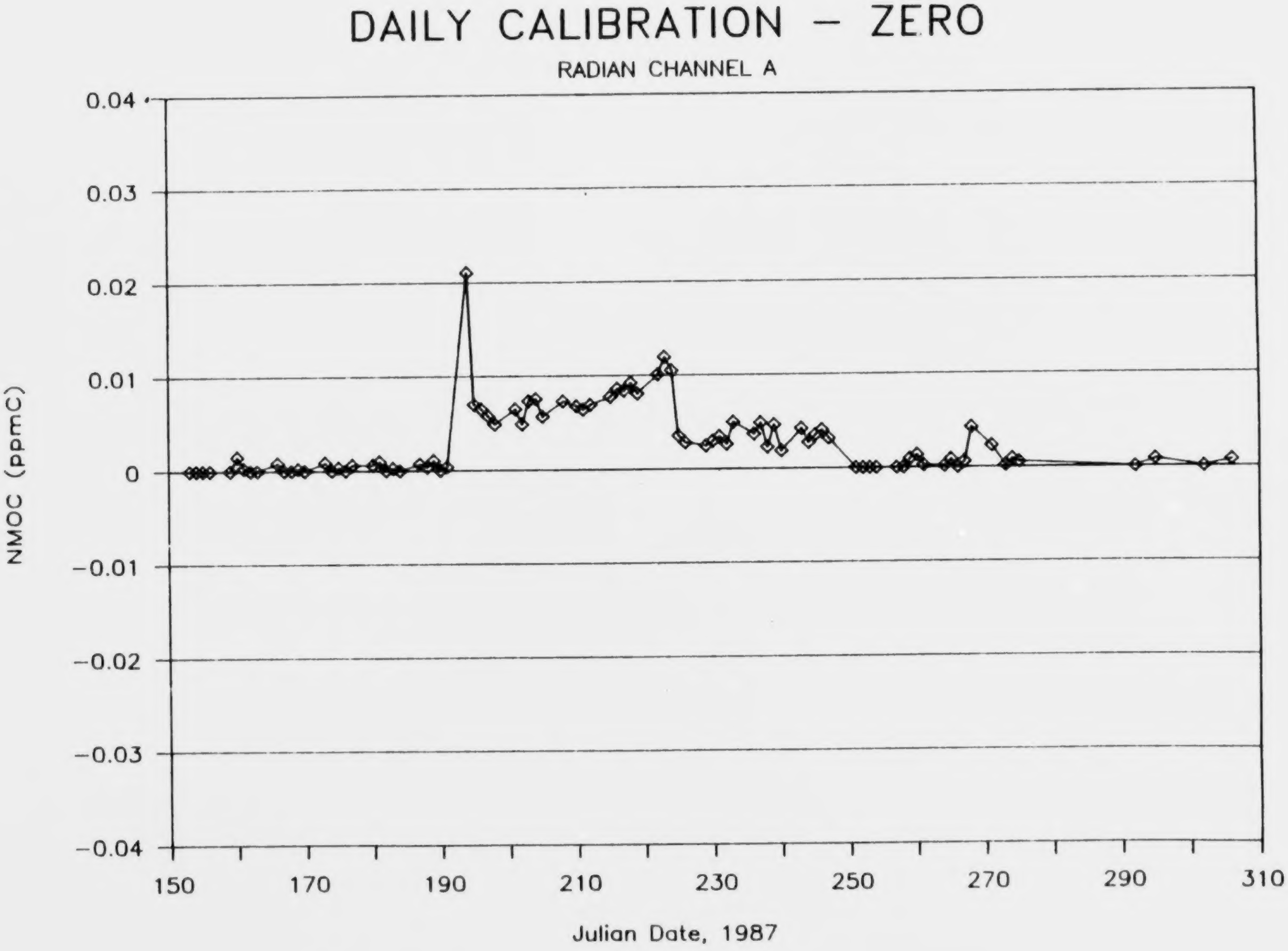

Figure 4-5. Daily calibration zero, Channel A.

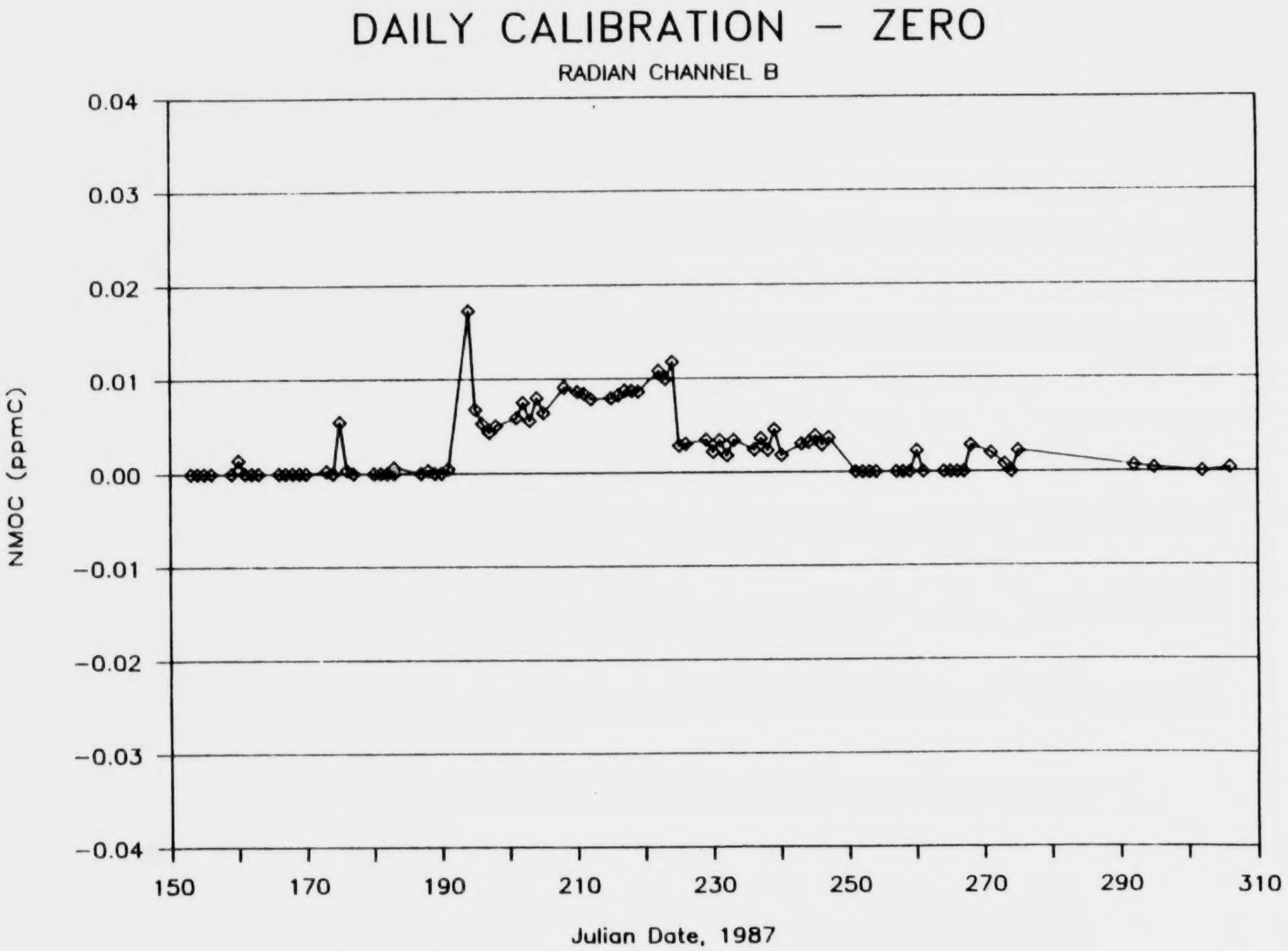

Figure 4-6. Daily calibration zero, Channel B.

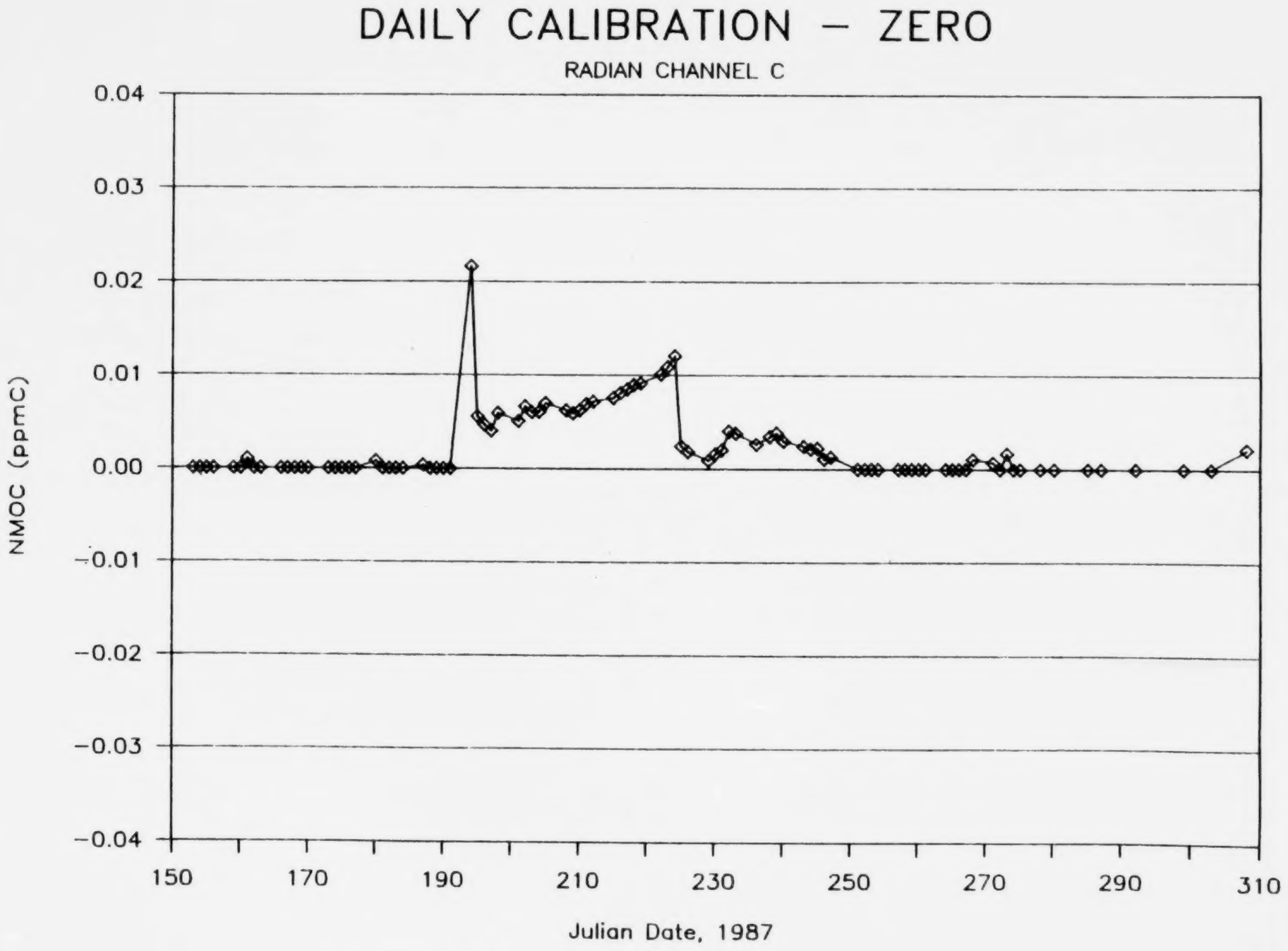

Figure 4-7. Daily calibration zero, Channel C.

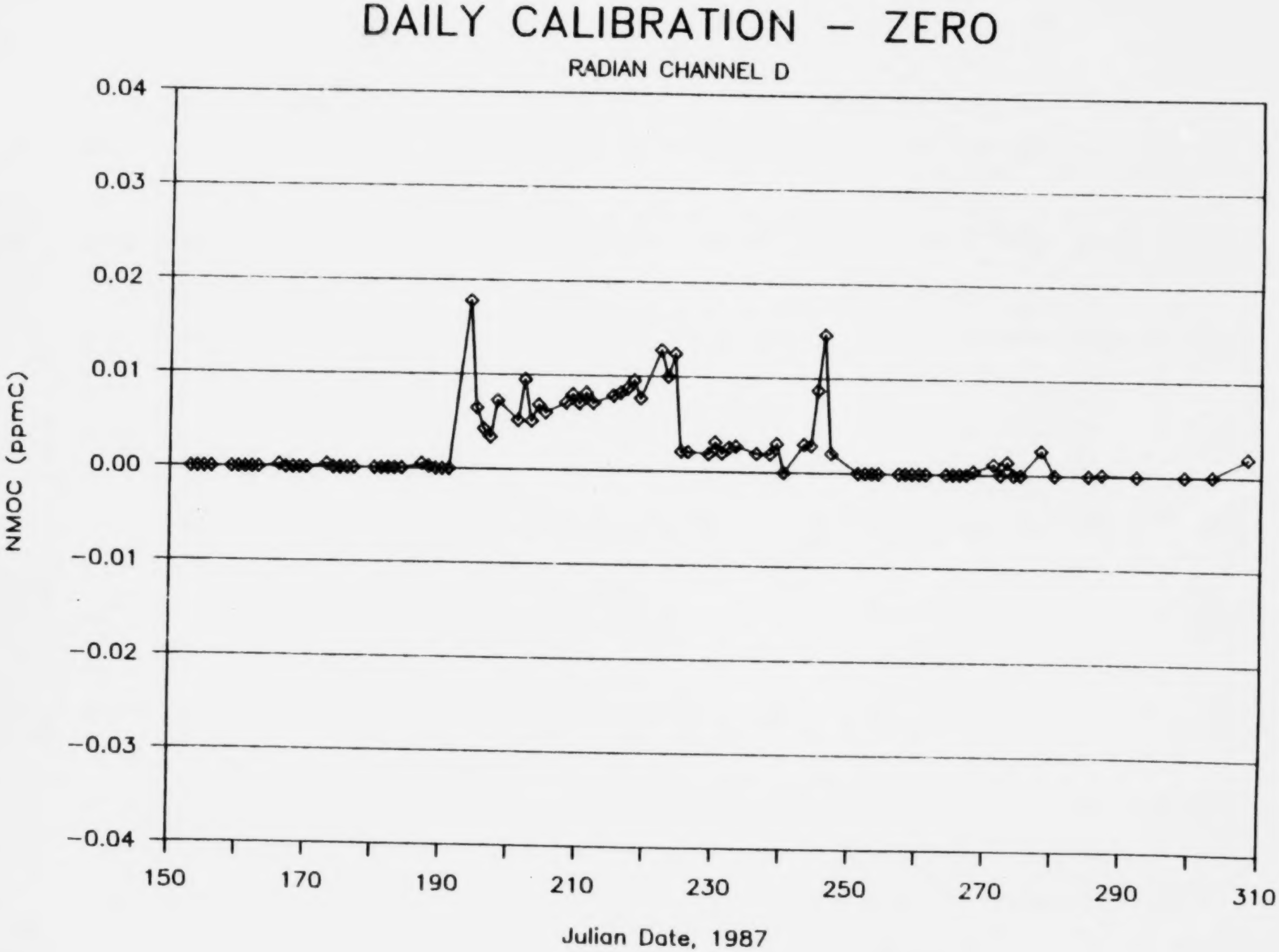

Figure 4-8. Daily calibration zero, Channel D.

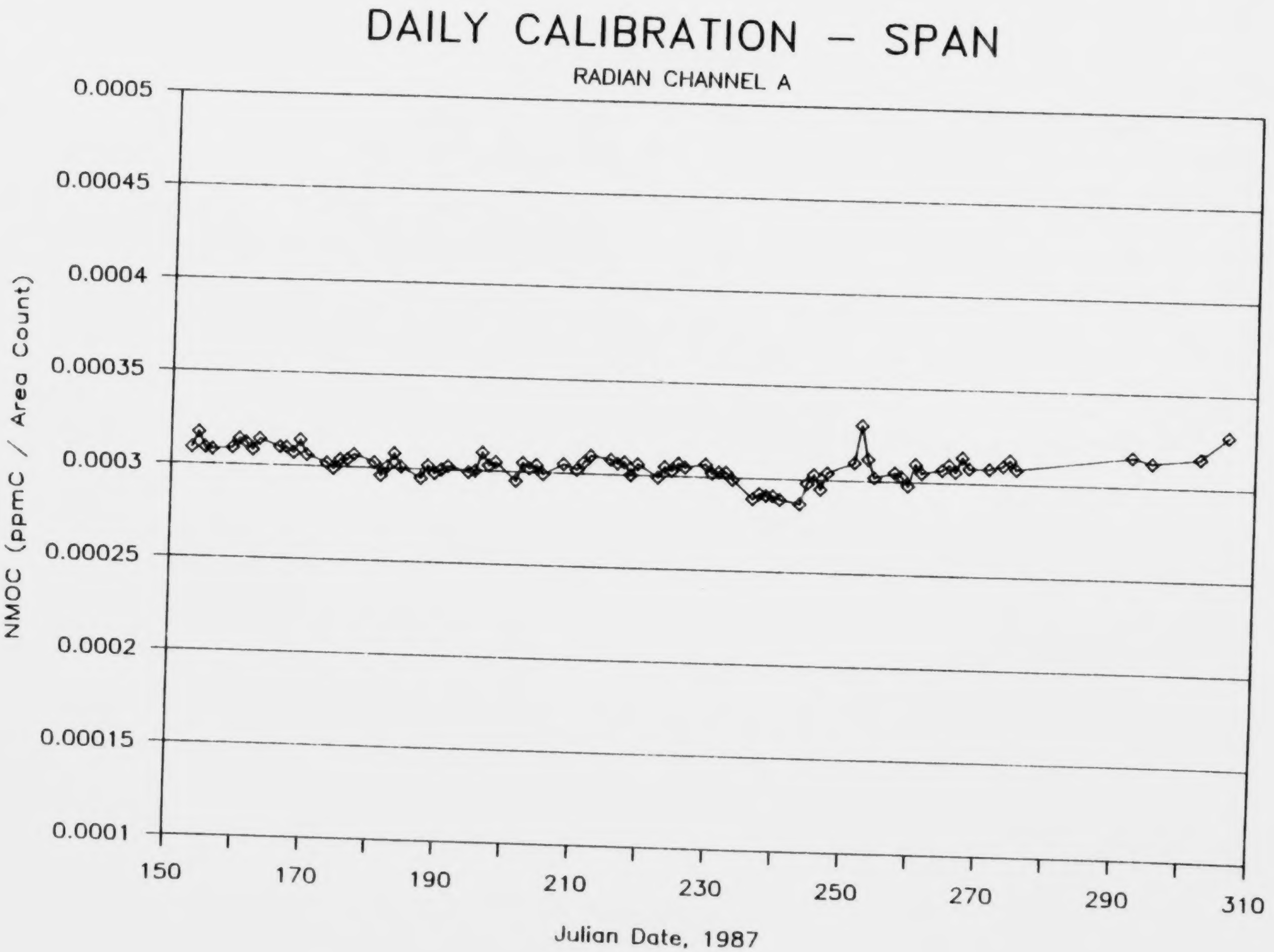

Figure 4-9. Daily calibration span, Channel A.

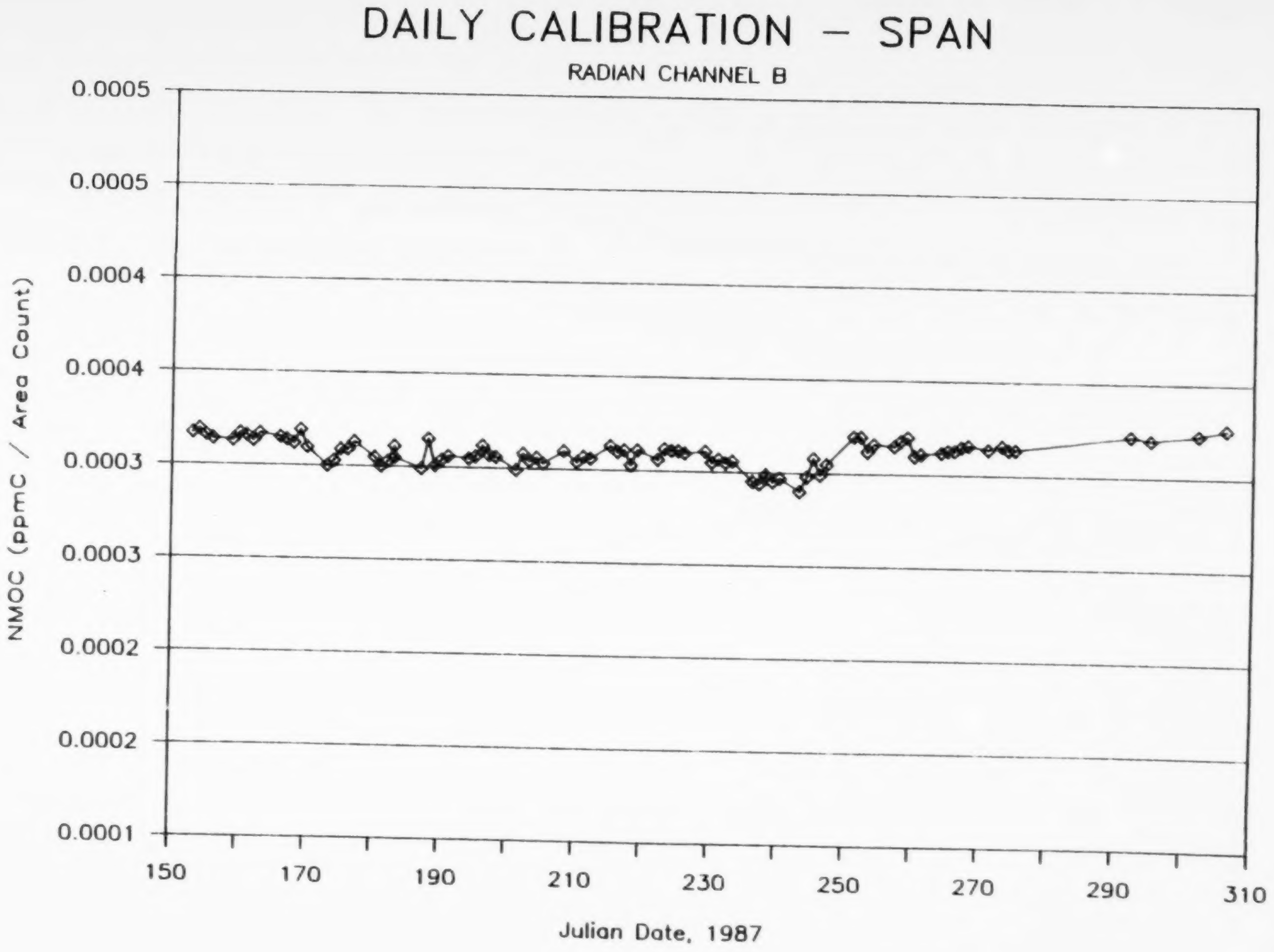

Figure 4-10. Daily calibration span, Channel B.

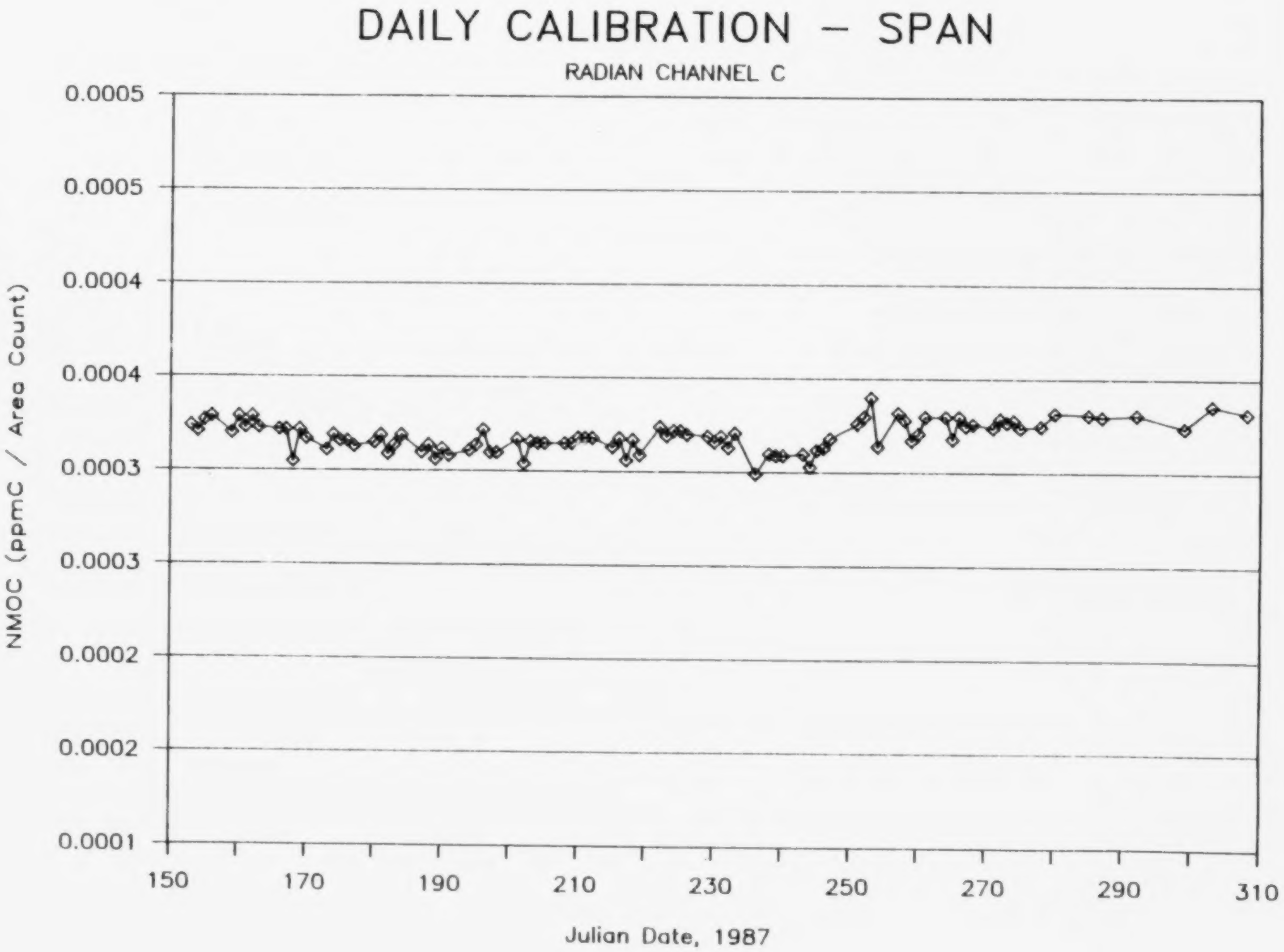

Figure 4-11. Daily calibration span, Channel C.

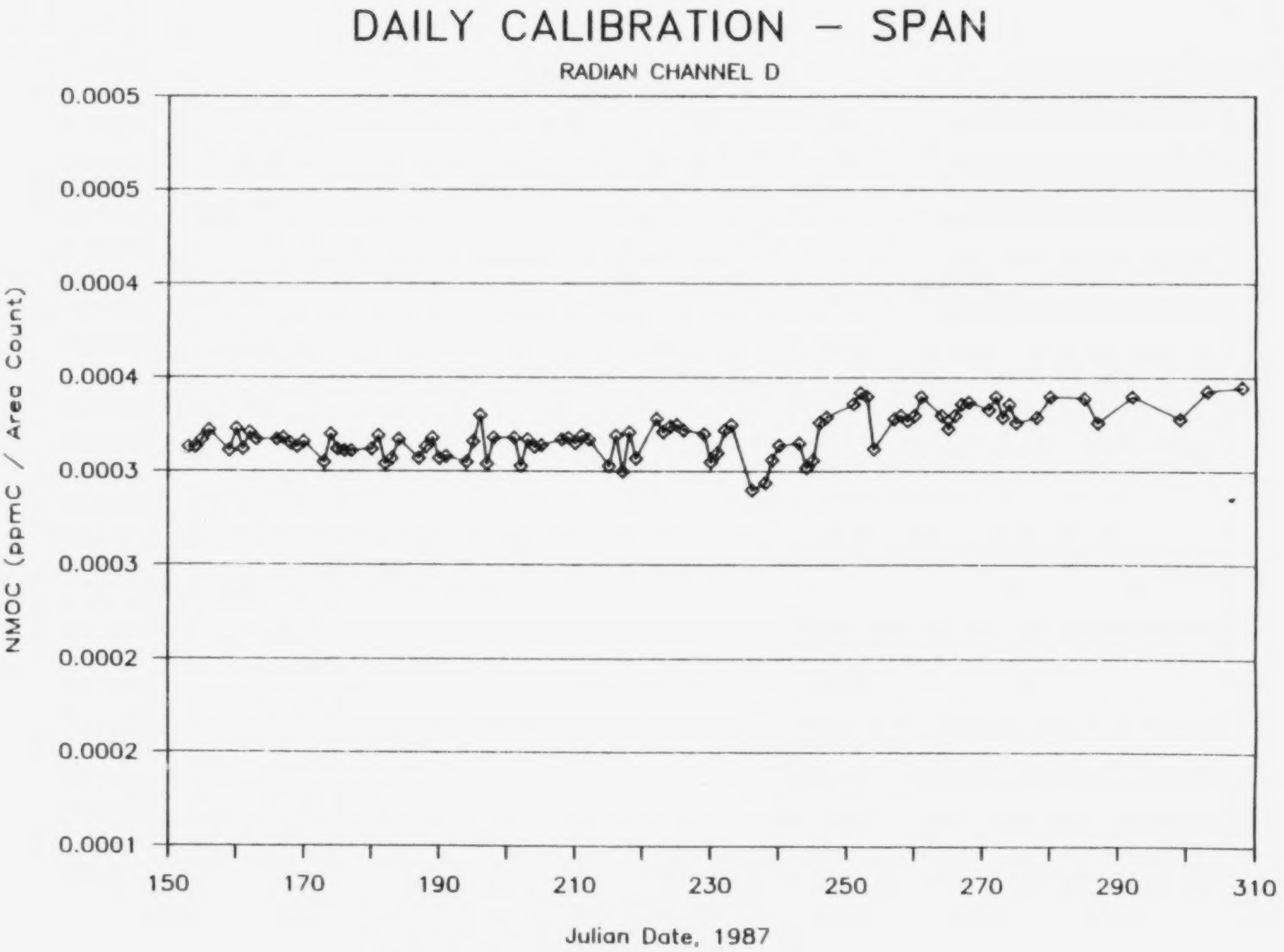

Figure 4-12. Daily calibration span, Channel D.

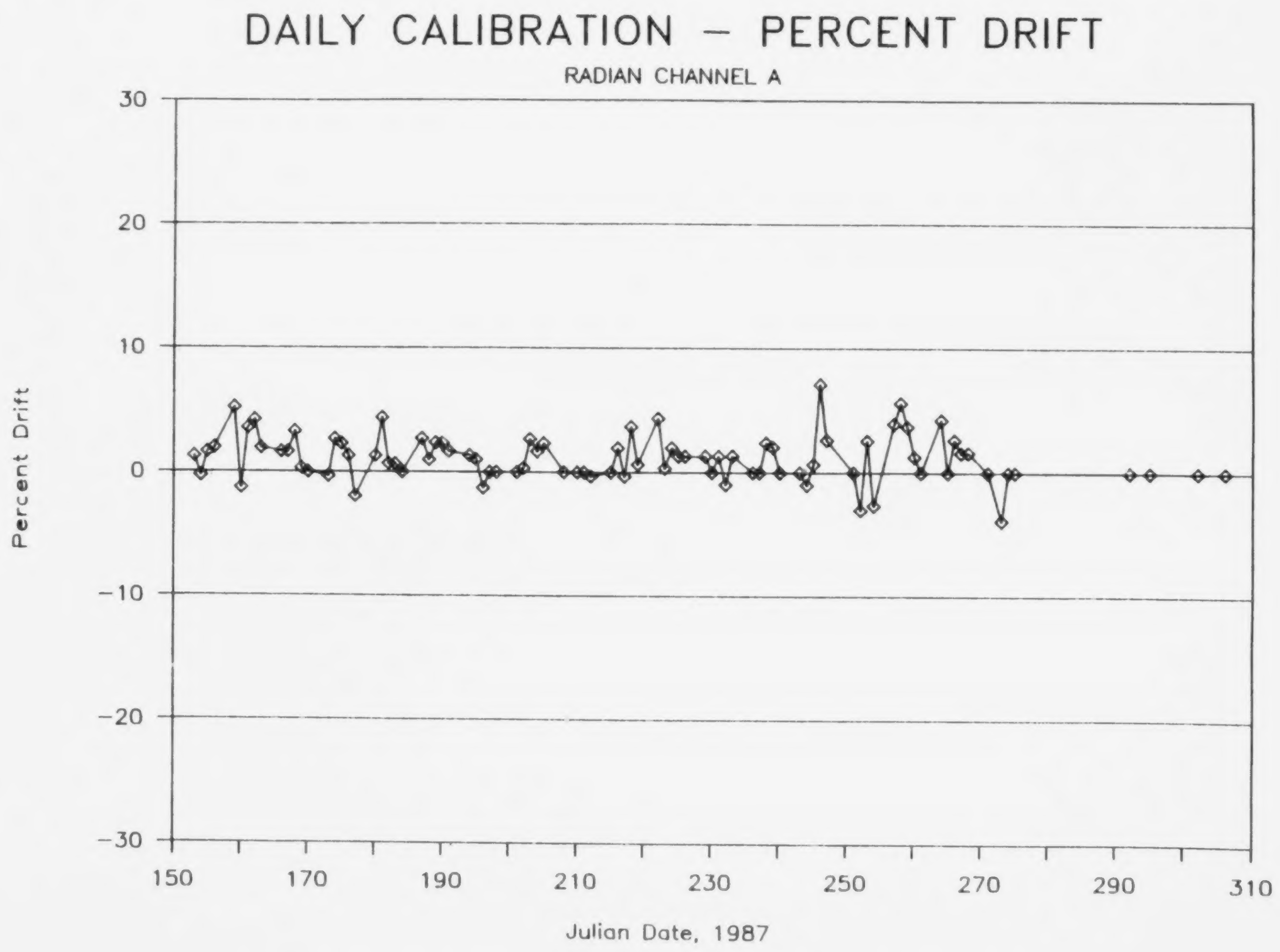

Figure 4-13. Daily calibration percent drift, Channel A.

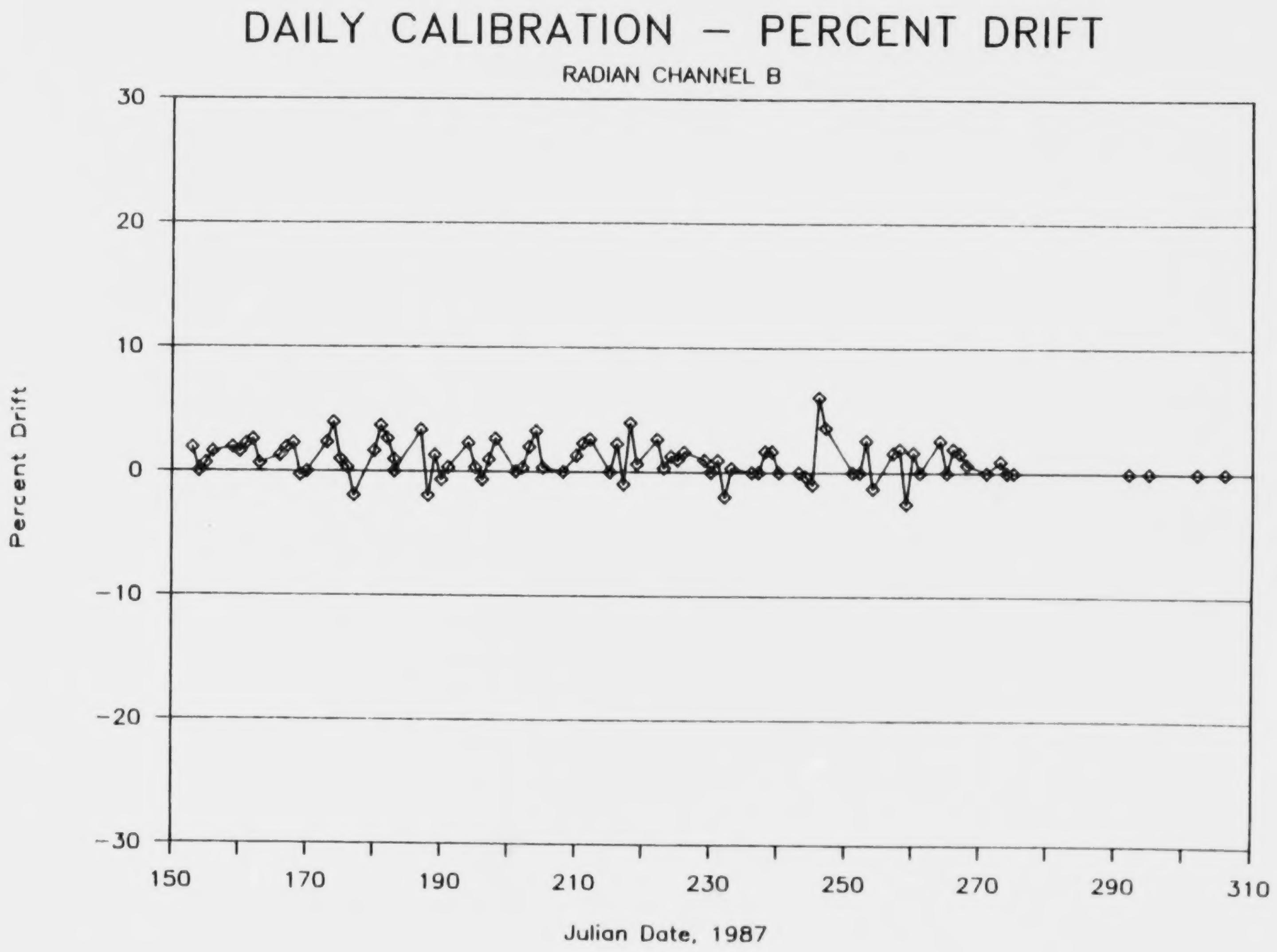

Figure 4-14. Daily calibration percent drift, Channel B.

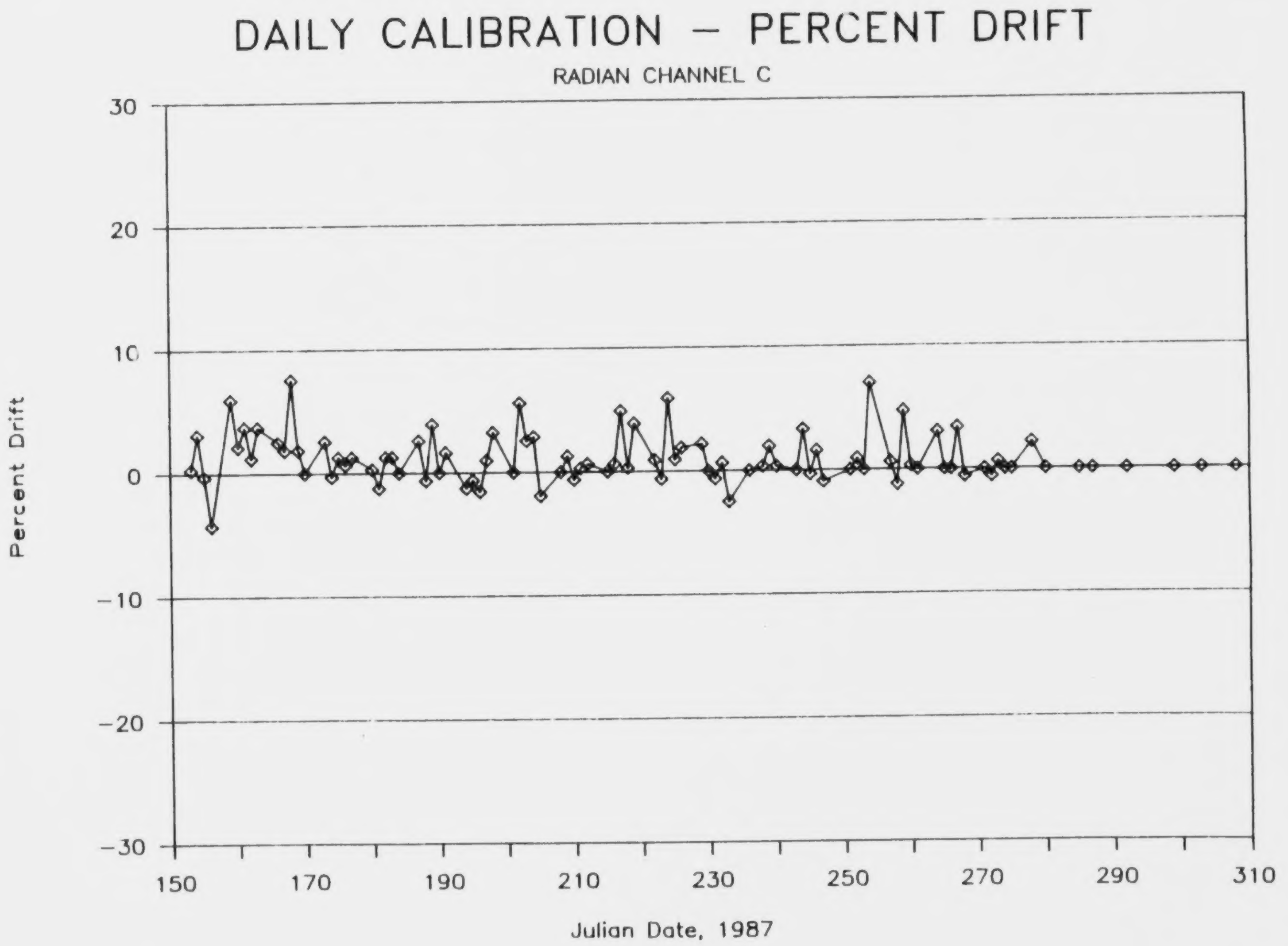

Figure 4-15. Daily calibration percent drift, Channel C.

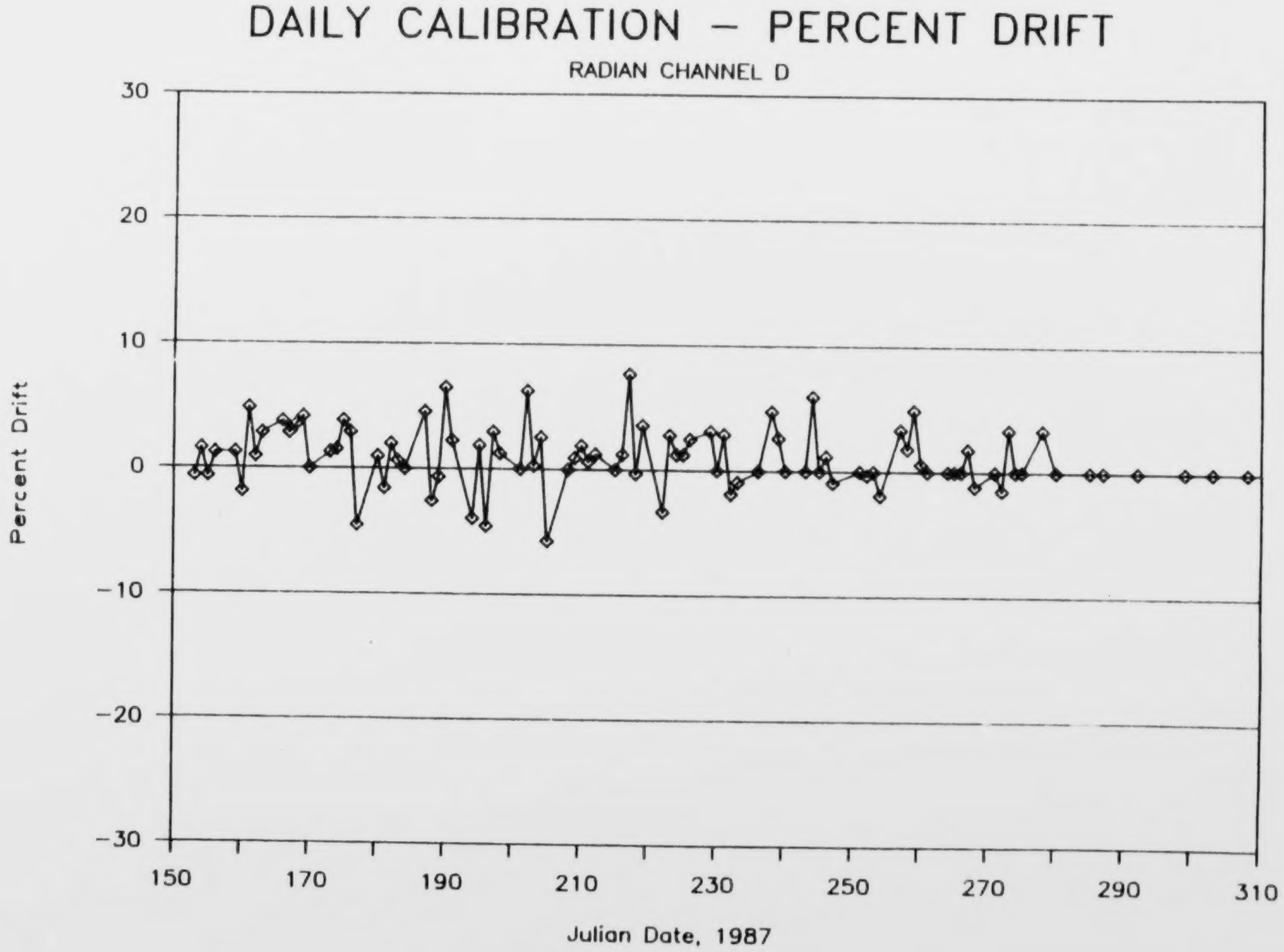

Figure 4-16. Daily calibration percent drift, Channel D.

TABLE 4-6. SUMMARY NMOC CALIBRATION FACTOR DRIFT RESULTS

Radian Channel	Cases	Calibration Factor Drift ppmC/Area Count x 10^{-6}			Percent Factor Drift			Absolute Percent Factor Drift	
		Min	Mean	Max	Min	Mean	Max	Mean	Standard Deviation
A	96	-12	3.3	21	-3.8710	1.0765	7.1186	1.4382	1.5190
B	96	-8	2.8	18	-2.5000	0.9275	6.0201	1.2075	1.2023
C	101	-15	3.1	23	-4.2553	0.9924	7.5410	1.3929	1.7030
D	101	-18	2.9	23	-5.7325	0.9374	7.6667	1.7063	1.8140
Overall	394	-18	3.03	23	-5.7325	0.9830	7.6667	1.4391	1.5857

4.2.2 Radian In-House NMOC QC Samples

Various statistics are given for Radian in-house QC samples in Tables 4-7 through 4-10. Samples were prepared by diluting propane with cleaned, dried air using calibrated flow controllers. The propane used to prepare the QC samples was certified by the EPA-QAD. In addition to the dates and identification numbers, Tables 4-7 through 4-10 show the gas concentrations calculated from the dilution measurements, and the gas concentrations measured by the Radian instrument channels. The differences between the measured NMOC concentrations and the calculated concentrations are given in ppmC and in percent, relative to the calculated ppmC.

Measured versus calculated NMOC concentrations in Figures 4-17 through 4-20 show excellent agreement. Table 4-11 summarizes the results of the orthogonal regressions assuming a linear relationship for the Radian in-house quality control data, showing regression intercepts near zero, and slopes and coefficients of correlation all near one.

Tables 4-12 and 4-13 give statistics for in-house quality control measurements. DIFF is the ppmC difference between the measured and the calculated NMOC concentrations, and PCDIFF is the percentage of the difference relative to the calculated value. Overall, PCDIFF shows a mean bias of -0.47 percent, and ranges from -0.85 percent for Channel D to 1.21 percent for Channel C. ADIFF and APCDIFF, absolute values of DIFF and PCDIFF, respectively, were used as measures of precision. The absolute percent difference ranged from 3.83 percent for Channel D to 5.01 percent for Channel A and averaged 4.44 percent. These figures show excellent agreement and consistency for the in-house quality control data and include errors, not only in the instrumental analysis but also in the apparatus and method which is used to generate the QC samples.

Figure 4-21 shows a stem-and-leaf plot of DIFF, the NMOC difference between the calculated and measured in-house quality control samples. The figure shows some negative skewness, but also shows the differences to be approximately normally distributed, which supports to the assertion that DIFF is a random variable. The normal distribution of DIFF also implies that there is no significant bias between instrument channels.

TABLE 4-7. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL A)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
06/19/87	170	1333	0.681	0.736	0.055	8.076
06/22/87	173	1370	1.344	1.331	-0.013	-0.967
06/23/87	174	1398	1.847	1.774	-0.073	-3.952
06/25/87	176	1399	0.997	0.973	-0.024	-2.407
06/29/87	180	1511	0.705	0.634	-0.071	-10.071
06/30/87	181	1564	0.458	0.431	-0.027	-5.895
07/01/87	182	1565	0.332	0.291	-0.041	-12.349
07/02/87	183	1566	0.195	0.185	-0.010	-5.128
07/07/87	188	1567	0.287	0.294	0.007	2.439
07/09/87	190	1710	0.324	0.326	0.002	0.617
07/10/87	191	1711	0.476	0.472	-0.004	-0.840
07/13/87	194	1792	0.533	0.539	0.006	1.126
07/14/87	195	1793	0.673	0.687	0.014	2.080
07/17/87	198	1964	0.857	0.864	0.007	0.817
07/20/87	201	1965	0.938	0.941	0.003	0.320
07/21/87	202	2043	2.840	2.820	-0.020	-0.704
07/23/87	204	2122	1.124	1.133	0.009	0.801
07/24/87	205	2123	1.281	1.309	0.028	2.186
07/29/87	210	2124	8.454	8.330	-0.124	-1.467
08/03/87	215	2370	1.430	1.439	0.009	0.629
08/04/87	216	2371	0.644	0.659	0.015	2.329
08/06/87	218	2372	0.046	0.070	0.024	52.174
08/11/87	223	2555	0.310	0.321	0.011	3.548
08/12/87	224	2579	0.353	0.376	0.023	6.516
08/14/87	226	2641	0.392	0.403	0.011	2.806
08/17/87	229	2700	0.822	0.821	-0.001	-0.122
08/19/87	231	2701	1.139	1.169	0.030	2.634
08/20/87	232	2756	1.215	1.257	0.042	3.457
08/21/87	233	2772	1.321	1.339	0.018	1.363
08/25/87	237	2774	1.488	1.500	0.012	0.806
08/27/87	239	2925	1.645	1.610	-0.035	-2.128
08/31/87	243	2926	1.073	1.028	-0.045	-4.194
09/02/87	245	2973	0.765	0.678	-0.087	-11.373
09/03/87	246	3068	0.819	0.755	-0.064	-7.814
09/09/87	252	3069	0.872	0.842	-0.030	-3.440
09/11/87	254	3070	0.923	0.907	-0.016	-1.733
09/14/87	257	3241	0.969	0.900	-0.069	-7.121
09/15/87	258	3242	0.994	0.910	-0.084	-8.451
09/16/87	259	3342	1.040	0.952	-0.088	-8.481
09/17/87	260	3343	1.082	1.057	-0.025	-2.329
09/18/87	261	3443	1.048	1.075	0.027	2.576
09/21/87	264	3444	1.098	1.043	-0.055	-5.009
09/23/87	266	3505	0.981	0.944	-0.037	-3.772

TABLE 4-7. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL A)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
09/24/87	267	3506	0.851	0.795	-0.056	-6.580
09/25/87	268	3507	0.748	0.736	-0.012	-1.604
09/30/87	273	3678	0.600	0.522	-0.078	-13.000
10/19/87	292	3831	0.449	0.449	0.000	0.000
10/22/87	295	3835	8.662	8.543	-0.119	-1.374
10/29/87	302	3847	0.237	0.234	-0.003	-1.266
11/02/87	306	3865	0.250	0.299	0.049	19.600
11/09/87	313	3867	0.253	0.257	0.004	1.581
11/12/87	316	3869	0.348	0.352	0.004	1.149

TABLE 4-8. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL B)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
06/19/87	170	1333	0.681	0.738	0.057	8.370
06/22/87	173	1370	1.344	1.316	-0.028	-2.083
06/23/87	174	1398	1.847	1.710	-0.137	-7.417
06/25/87	176	1399	0.997	0.984	-0.013	-1.304
06/29/87	180	1511	0.705	0.690	-0.015	-2.128
06/30/87	181	1564	0.458	0.432	-0.026	-5.677
07/01/87	182	1565	0.332	0.297	-0.035	-10.542
07/02/87	183	1566	0.195	0.186	-0.009	-4.615
07/07/87	188	1567	0.287	0.300	0.013	4.530
07/09/87	190	1710	0.324	0.336	0.012	3.704
07/10/87	191	1711	0.476	0.499	0.023	4.832
07/13/87	194	1792	0.533	0.549	0.016	3.002
07/14/87	195	1793	0.673	0.695	0.022	3.269
07/17/87	198	1964	0.857	0.885	0.028	3.267
07/20/87	201	1965	0.938	0.938	0.000	0.000
07/21/87	202	2043	2.840	2.846	0.006	0.211
07/23/87	204	2122	1.124	1.083	-0.041	-3.648
07/24/87	205	2123	1.281	1.233	-0.048	-3.747
07/29/87	210	2124	8.454	8.222	-0.232	-2.744
08/03/87	215	2370	1.430	1.451	0.021	1.469
08/04/87	216	2371	0.644	0.662	0.018	2.795
08/06/87	218	2372	0.046	0.061	0.015	32.609
08/11/87	223	2555	0.310	0.327	0.017	5.484
08/12/87	224	2579	0.353	0.368	0.015	4.249
08/14/87	226	2641	0.392	0.397	0.005	1.276
08/17/87	229	2700	0.822	0.833	0.011	1.338
08/19/87	231	2701	1.139	1.178	0.039	3.424
08/20/87	232	2756	1.215	1.241	0.026	2.140
08/21/87	233	2772	1.321	1.363	0.042	3.179
08/25/87	236	2774	1.488	1.470	-0.018	-1.210
08/27/87	238	2925	1.645	1.620	-0.025	-1.520
08/31/87	243	2926	1.073	1.025	-0.048	-4.473
09/02/87	245	2973	0.768	0.726	-0.042	-5.469
09/03/87	246	3068	0.819	0.716	-0.103	-12.576
09/09/87	252	3069	0.872	0.805	-0.067	-7.683
09/11/87	254	3070	0.923	0.893	-0.030	-3.250
09/14/87	257	3241	0.969	0.918	-0.051	-5.263
09/15/87	258	3242	0.994	0.949	-0.045	-4.527
09/16/87	259	3342	1.040	0.994	-0.046	-4.385
09/17/87	260	3343	1.087	1.044	-0.043	-3.947
09/18/87	261	3443	1.048	1.077	0.029	2.767
09/21/87	264	3444	1.098	1.044	-0.054	-4.918
09/23/87	266	3505	0.981	0.929	-0.052	-5.301

TABLE 4-8. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL B)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
09/24/87	267	3506	0.851	0.813	-0.038	-4.465
09/25/87	268	3507	0.748	0.731	-0.017	-2.273
09/30/87	273	3678	0.600	0.528	-0.072	-12.000
10/19/87	292	3831	0.449	0.449	0.000	0.000
10/22/87	295	3835	8.662	8.207	-0.455	-5.253
10/29/87	302	3847	0.237	0.241	0.004	1.688
11/02/87	306	3865	0.250	0.289	0.039	15.600
11/09/87	313	3867	0.253	0.263	0.010	3.953
11/12/87	316	3869	0.348	0.360	0.012	3.448

TABLE 4-9. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL C)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
06/19/87	170	1333	0.681	0.726	0.045	6.608
06/22/87	173	1370	1.344	1.367	0.023	1.711
06/23/87	174	1398	1.847	1.809	-0.038	-2.057
06/25/87	176	1399	0.997	0.990	-0.007	-0.702
06/26/87	177	1400	0.392	0.352	-0.040	-10.204
06/29/87	180	1511	0.705	0.694	-0.011	-1.560
06/30/87	181	1564	0.458	0.458	0.000	0.000
07/01/87	182	1565	0.332	0.307	-0.025	-7.530
07/02/87	183	1566	0.195	0.182	-0.013	-6.667
07/07/87	188	1567	0.287	0.293	0.006	2.091
07/09/87	190	1710	0.324	0.334	0.010	3.086
07/10/87	191	1711	0.476	0.491	0.015	3.151
07/13/87	194	1792	0.533	0.552	0.019	3.565
07/14/87	195	1793	0.673	0.671	-0.002	-0.297
07/17/87	198	1964	0.857	0.875	0.018	2.100
07/20/87	201	1965	0.938	0.965	0.027	2.878
07/21/87	202	2043	2.840	2.766	-0.074	-2.606
07/23/87	204	2122	1.124	1.131	0.007	0.623
07/24/87	205	2123	1.281	1.311	0.030	2.342
07/28/87	209	2124	8.454	8.303	-0.151	-1.786
07/29/87	210	2124	8.454	7.976	-0.478	-5.654
08/03/87	215	2370	1.430	1.413	-0.017	-1.189
08/04/87	216	2371	0.644	0.657	0.013	2.019
08/06/87	218	2372	0.046	0.057	0.011	23.913
08/11/87	223	2555	0.310	0.337	0.027	8.710
08/12/87	224	2579	0.353	0.387	0.034	9.632
08/14/87	226	2641	0.392	0.393	0.001	0.255
08/17/87	229	2700	0.822	0.825	0.003	0.365
08/19/87	231	2701	1.139	1.166	0.027	2.371
08/20/87	232	2756	1.215	1.240	0.025	2.058
08/21/87	233	2772	1.321	1.343	0.022	1.665
08/27/87	239	2925	1.645	1.929	0.284	17.264
08/31/87	243	2926	1.073	1.043	-0.030	-2.796
09/03/87	246	3068	0.819	0.741	-0.078	-9.524
09/09/87	252	3069	0.872	0.859	-0.013	-1.491
09/11/87	254	3070	0.923	0.871	-0.052	-5.612
09/14/87	257	3241	0.969	0.928	-0.041	-4.231
09/15/87	258	3242	0.994	0.950	-0.044	-4.386
09/16/87	259	3342	1.040	0.951	-0.089	-8.558
09/17/87	260	3343	1.082	1.021	-0.061	-5.638
09/18/87	261	3443	1.048	1.063	0.015	1.441
09/21/87	264	3444	1.098	1.086	-0.012	-1.093
09/23/87	266	3505	0.981	0.953	-0.028	-2.854

TABLE 4-9. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL C)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
09/24/87	267	3506	0.851	0.800	-0.051	-5.993
09/25/87	268	3507	0.748	0.726	-0.022	-2.941
09/29/87	272	3508	0.622	0.601	-0.021	-3.376
09/30/87	273	3678	0.600	0.528	-0.072	-12.000
10/12/87	285	3819	0.519	0.505	-0.014	-2.697
10/19/87	292	3831	0.449	0.452	0.003	0.668
10/26/87	299	3846	0.216	0.224	0.008	3.704
10/30/87	303	3859	0.233	0.233	0.000	0.000
11/04/87	308	3866	2.936	2.949	0.013	0.443
11/10/87	314	3868	0.280	0.286	0.006	2.143
11/13/87	317	3869	0.348	0.362	0.014	4.023

TABLE 4-10. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL D)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
06/19/87	170	1333	0.681	0.644	-0.037	-5.433
06/22/87	173	1370	1.344	1.368	0.024	1.786
06/23/87	174	1398	1.847	1.817	-0.030	-1.624
06/25/87	176	1399	0.997	1.017	0.020	2.006
06/26/87	177	1400	0.392	0.358	-0.034	-8.673
06/29/87	180	1511	0.705	0.672	-0.033	-4.681
06/30/87	181	1564	0.458	0.461	0.003	0.655
07/01/87	182	1565	0.332	0.311	-0.021	-6.325
07/02/87	183	1566	0.195	0.177	-0.018	-9.231
07/07/87	188	1567	0.287	0.295	0.008	2.787
07/09/87	190	1710	0.324	0.348	0.024	7.407
07/10/87	191	1711	0.476	0.490	0.014	2.941
07/13/87	194	1792	0.533	0.549	0.016	3.002
07/14/87	195	1793	0.673	0.656	-0.017	-2.526
07/17/87	198	1964	0.857	0.854	-0.003	-0.350
07/20/87	201	1965	0.938	0.952	0.014	1.493
07/21/87	202	2043	2.840	2.678	-0.162	-5.704
07/23/87	204	2122	1.124	1.110	-0.014	-1.246
07/24/87	205	2123	1.281	1.288	0.007	0.546
07/28/87	209	2124	8.454	8.378	-0.076	-0.899
07/29/87	210	2124	8.454	8.065	-0.389	-4.601
08/03/87	215	2370	1.430	1.377	-0.053	-3.706
08/04/87	216	2371	0.644	0.654	0.010	1.553
08/06/87	218	2372	0.046	0.055	0.009	19.565
08/11/87	223	2555	0.310	0.347	0.037	11.935
08/12/87	224	2579	0.353	0.363	0.010	2.833
08/14/87	226	2641	0.392	0.394	0.002	0.510
08/17/87	229	2700	0.822	0.809	-0.013	-1.582
08/19/87	231	2701	1.139	1.114	-0.025	-2.195
08/20/87	232	2756	1.215	1.306	0.091	7.490
08/21/87	233	2772	1.321	1.323	0.002	0.151
08/26/87	238	2773	1.462	1.369	-0.093	-6.361
08/27/87	239	2925	1.645	1.619	-0.026	-1.581
08/31/87	243	2926	1.073	1.047	-0.026	-2.423
09/03/87	246	3068	0.819	0.763	-0.056	-6.838
09/09/87	252	3069	0.872	0.871	-0.001	-0.115
09/11/87	254	3070	0.923	0.900	-0.023	-2.503
09/14/87	257	3241	0.969	0.920	-0.049	-5.046
09/15/87	258	3242	0.994	0.958	-0.036	-3.642
09/16/87	259	3342	1.040	0.963	-0.077	-7.404
09/17/87	260	3343	1.087	1.030	-0.057	-5.244
09/18/87	261	3443	1.048	1.097	0.048	4.628
09/21/87	264	3444	1.098	1.094	-0.004	-0.364

TABLE 4-10. NMOC IN-HOUSE QUALITY CONTROL SAMPLES (CHANNEL D)

Date Analyzed	Julian Date Analyzed	Radian ID Number	NMOC Calculated Concentration ppmC	NMOC Measured Concentration ppmC	NMOC Difference ppmC	NMOC Difference (%)
09/23/87	266	3505	0.981	0.961	-0.020	-2.039
09/24/87	267	3506	0.851	0.849	-0.002	-0.235
09/25/87	268	3507	0.748	0.759	0.011	1.471
09/29/87	272	3508	0.622	0.596	-0.026	-4.180
09/30/87	273	3678	0.600	0.516	-0.084	-14.000
10/12/87	285	3819	0.519	0.501	-0.018	-3.468
10/19/87	292	3831	0.449	0.454	0.005	1.114
10/26/87	299	3846	0.216	0.218	0.002	0.926
10/30/87	303	3859	0.233	0.233	0.000	0.000
11/04/87	308	3866	2.936	3.057	0.121	4.121
11/10/87	314	3868	0.280	0.269	-0.011	-3.929
11/13/87	317	3869	0.348	0.356	0.008	2.299

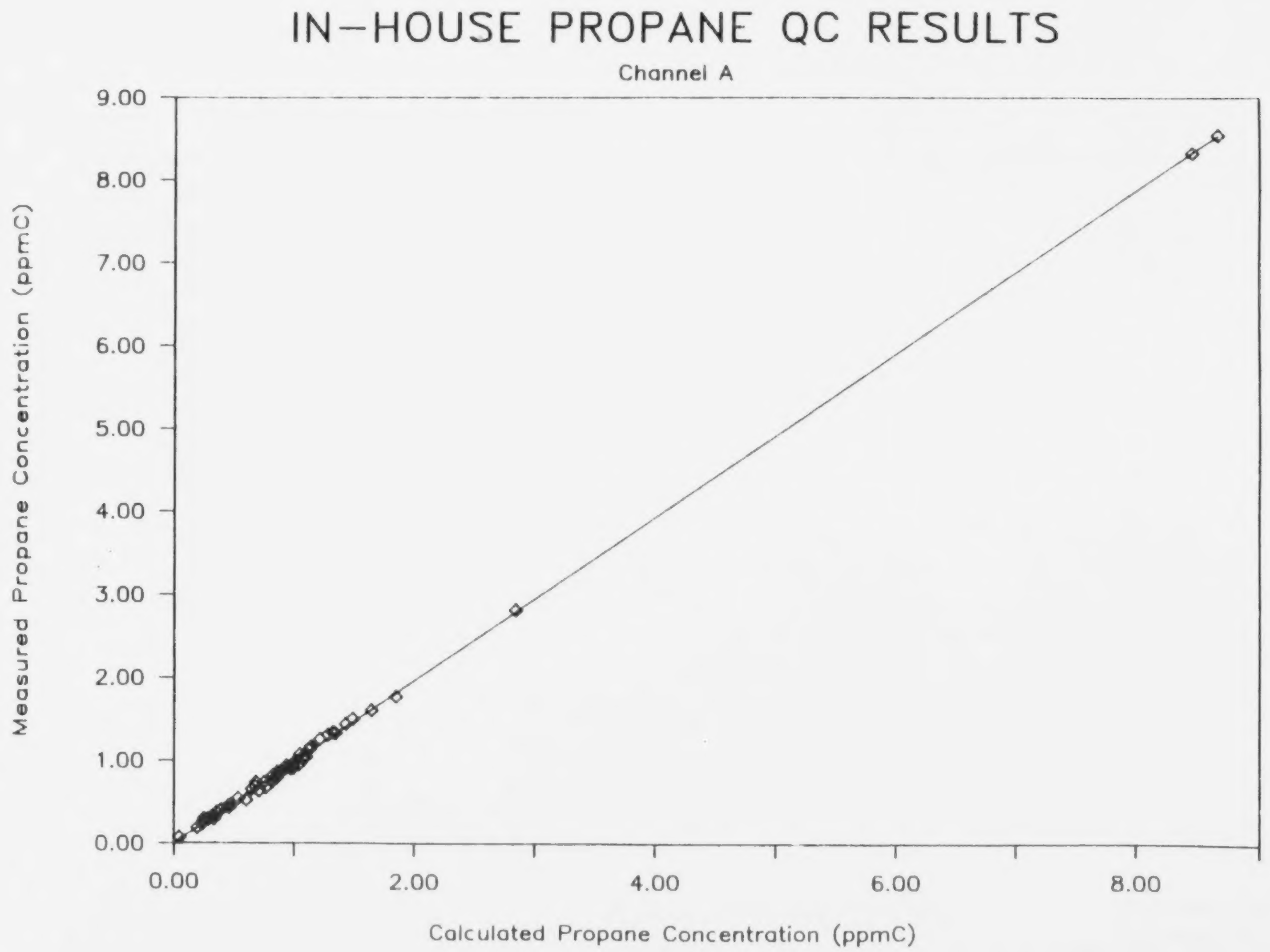

Figure 4-17. In-house quality control results, Channel A.

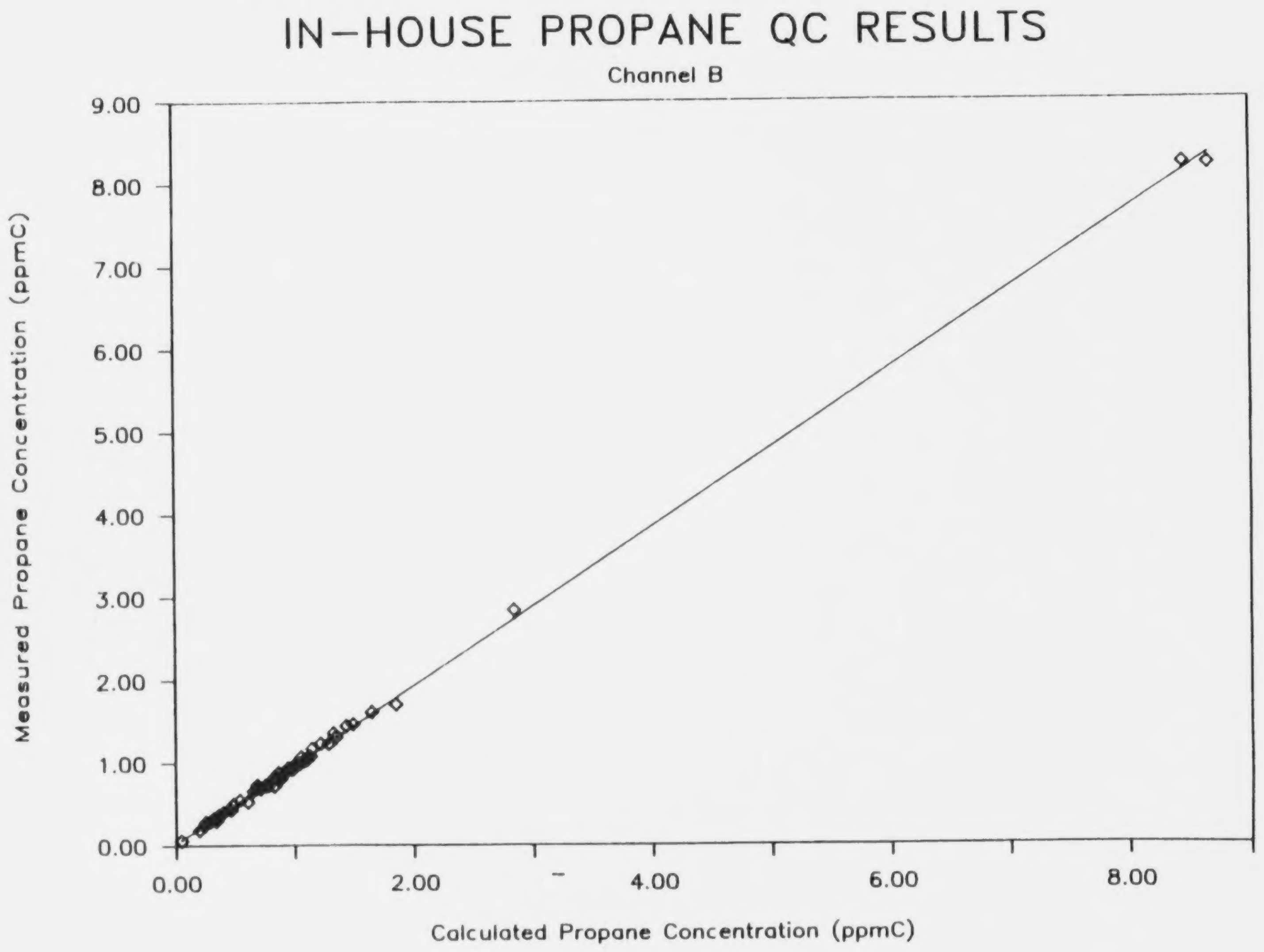

Figure 4-18. In-house quality control results, Channel B.

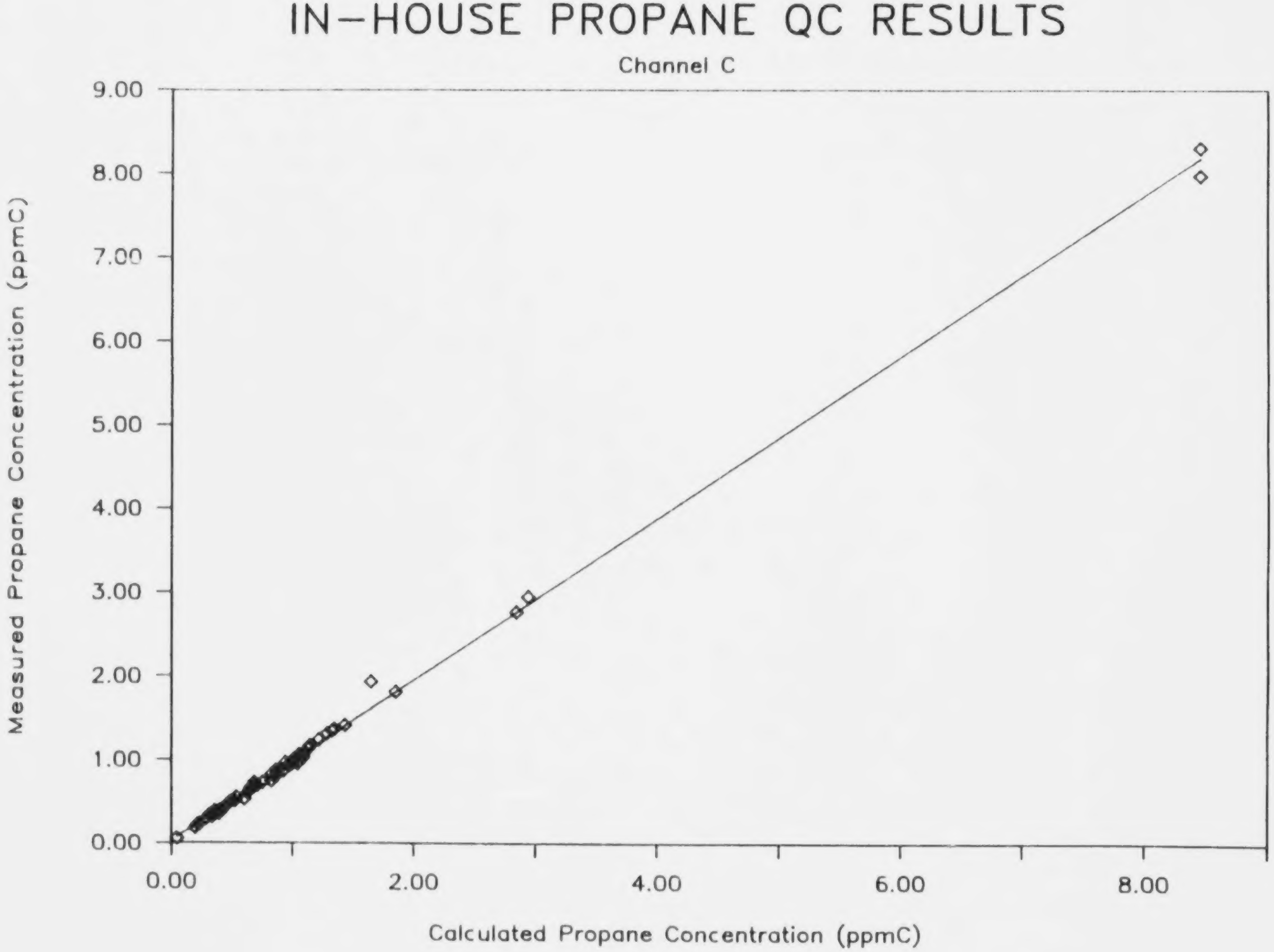

Figure 4-19. In-house quality control results, Channel C.

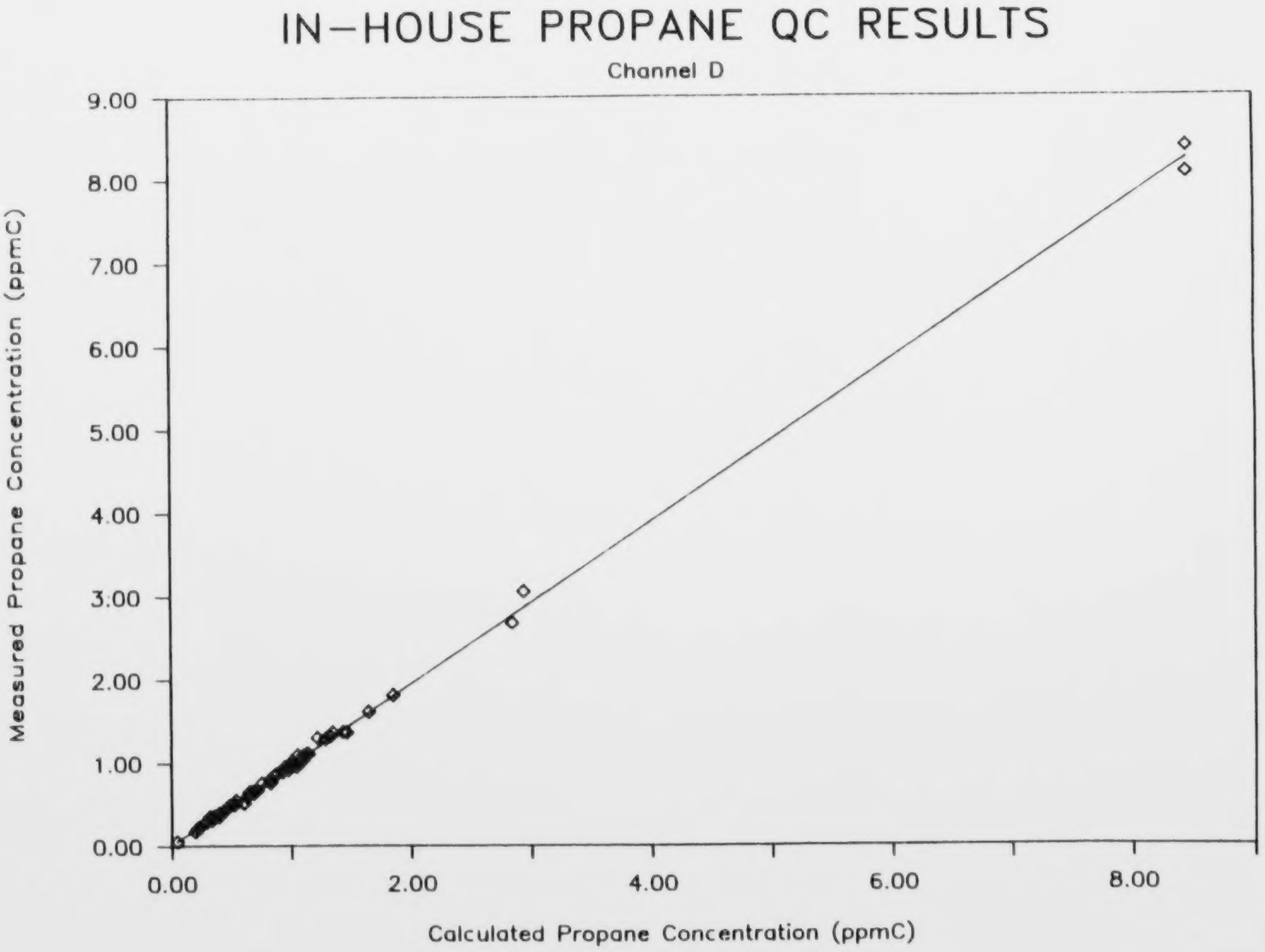

Figure 4-20. In-house quality control results, Channel D.

TABLE 4-11. ORTHOGONAL REGRESSION PARAMETERS FOR IN-HOUSE QUALITY CONTROL DATA

Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	50	-0.002140	0.986320	0.999734
B	50	0.020943	0.959413	0.999582
C	52	0.024876	0.965475	0.999085
D	53	0.010937	0.973832	0.999392

TABLE 4-12. IN-HOUSE QUALITY CONTROL STATISTICS, BY RADIAN CHANNEL

		Variables			
Channel	Statistics	DIFF[a]	ADIFF[b]	PCIFF[c]	APCDIFF[d]
A	Cases	50	50	50	50
	Minimum	-0.12400	0.00000	-13.00000	0.00000
	Maximum	0.05500	0.12400	52.17391	52.17390
	Mean	-0.01818	0.03426	-0.33343	5.00941
	Std. Dev.	0.04268	0.03099	9.37434	7.89842
	Std. Error	0.00603	0.00438	1.32573	1.11700
	Skewness	-0.63322	1.14187	3.63363	4.51795
	Kurtosis	0.29518	0.62077	18.18366	23.80398
B	Cases	50	50	50	50
	Minimum	-0.45500	0.00000	-12.57600	0.00000
	Maximum	0.05700	0.45500	32.60900	32.60870
	Mean	-0.02664	0.04495	-0.46430	4.83241
	Std. Dev.	0.07916	0.07020	7.04354	5.09927
	Std. Error	0.01119	0.00992	0.99610	0.72114
	Skewness	-3.8616	4.50951	2.11300	3.58225
	Kurtosis	15.99441	22.38867	8.28383	16.06771
C	Cases	52	52	52	52
	Minimum	-0.47800	0.00000	-12.00000	0.00000
	Maximum	0.28400	0.47800	23.91300	23.91304
	Mean	-0.01534	0.04122	-0.20728	4.15587
	Std. Dev.	0.08565	0.07616	6.13281	4.47720
	Std. Error	0.01187	0.01056	0.85046	0.62087
	Skewness	-2.35919	4.38513	1.37540	2.32254
	Kurtosis	17.16937	20.67629	4.08732	6.56499
D	Cases	53	53	53	53
	Minimum	-0.38900	0.00000	-14.00000	0.00000
	Maximum	0.12100	0.38900	19.56500	19.56522
	Mean	-0.01971	0.03976	-0.85469	3.83281
	Std. Dev.	0.6743	0.05908	5.33015	3.76599
	Std. Error	0.00926	0.00811	0.73215	0.51729
	Skewness	-3.11598	4.29806	0.97414	1.95432
	Kurtosis	15.64371	22.01107	3.27821	4.81542

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[a] DIFF = Measured NMOC Concentration - Calculated NMOC concentration, ppmC.

[b] ADIFF = Absolute value of DIFF, ppmC.

[c] PCDIFF = DIFF / Calculated NMOC concentration x 100.

[d] APCDIFF = Absolute value of PCDIFF.

TABLE 4-13. OVERALL IN-HOUSE QUALITY CONTROL STATISTICS

	Variables			
Statistics	DIFF[a]	ADIFF[b]	PCDIFF[c]	APCDIFF[d]
Cases	205	205	205	205
Minimum	-0.47800	0.00000	-14.00000	0.00000
Maximum	0.28400	0.47800	52.17391	52.17390
Mean	-0.01992	0.03966	-0.46812	4.44554
Std. Dev.	0.07038	0.06140	7.05194	5.48547
Std. Error	0.00491	0.00428	0.49252	0.38312
Skewness	-2.00567	4.76877	2.88922	4.50538
Kurtosis	19.33574	27.23057	16.98976	30.53460

[a] DIFF = Measured NMOC concentration - Calculated NMOC concentration, ppmC.

[b] ADIFF = Absolute value of DIFF.

[c] PCDIFF = DIFF/calculated NMOC concentration x 100.

[d] APCDIFF = Absolute value of PCDIFF.

	DIFF, ppmC
Cases	205
Minimum	-0.478
Maximum	2.284
Mean	-0.020
Standard Deviation	0.070
Standard Error	0.005
Skewness	-3.006
Kurtosis	19.336
Lower Hinge (H)	-0.040
Median (M)	-0.009
Upper Hinge (H)	0.013

```
-47     8
-45     5
-38     9
-23     2
-16     2
-15     1
-13     7
-12     4
-11     9
-10     3
 -9     3
 -8     98744
 -7     88764 3221
 -6     9741
 -5     76654 32211
 -4 H   98876 54321 110
 -3     88778 55430 000
 -2     88768 66555 54321 100
 -1     88877 76544 33333 2210
 -0 M   97443 3221
  0     00000 01222 23333 45566 67777 88999
  1 H   00011 11122 33344 45555 56678 889
  2     01223 33444 56777 7889
  3     00479 9
  4     22589
  5     57
  6
  7
  8
  9     1
 12     1
 28     4
```

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Figure 4-21. Stem-and-leaf plot of in-house quality control differences.

4.2.3 Comparable Analyses

Two types of comparable, or repeated analyses were conducted in this study. The first type of repeated analysis was conducted primarily to establish precision, and to determine if significant differences in precision existed among Radian (PDFID) channels, the EPA-QAD (PDFID) channel, and the EPA-ASRL (GC/FID) channel. Two samples daily were selected from the received site samples for a second analysis on a Radian channel. The schedule of which Radian channels were selected for the repeated analyses was specified by the Quality Assurance Project Plan (QAPP)[1], so that all combinations of channel pairs, i.e., A-A, B-B, B-C, A-D, etc., would be selected randomly. The EPA-QAD and the EPA-ASRL channels randomly repeated analyses of the site samples already analyzed once by Radian. None of the site samples selected for repeated analyses by Radian channels was analyzed a third time by an EPA channel.

The second type of comparative analysis was done on local ambient samples collected by EPA-QAD personnel at or near Research Triangle Park, NC. These samples were taken once weekly in duplicate at an initial pressure of about 35 psig. Each local ambient sample, called a "round-robin sample," was analyzed by all four Radian channels, the EPA-QAD channel, and the EPA-ASRL channel. One of the duplicate round-robin samples was analyzed first in the Radian laboratory while the other duplicate round-robin sample was analyzed first in the EPA laboratories. Upon completion of the analyses, the laboratories exchanged canisters, and analyzed the other duplicate sample on all channels. The purposes of these studies were:

- to determine if the order of analysis by one laboratory or channel made a significant difference in the measured NMOC value;
- to compare the precision of all the channels;
- to compare the PDFID method of analysis with the GCFID method of analysis; and
- to compare the results between channels.

The first type of comparable NMOC analysis is described in Section 4.2.3.1, the second type in Section 4.2.3.2.

4.2.3.1 NMOC Site Sample Comparable Analyses. Figure 4-22 compares the EPA-QAD analyses with Radian analyses of the same site samples. Figure 4-23 compares the EPA-ASRL analyses with Radian analyses. Figure 4-24 compares ASRL analyses with QAD analyses. Orthogonal regression parameters for the three data sets are summarized in Table 4-14.

Summary statistics of the comparative analyses for Radian channels versus the EPA-QAD channel are given in Table 4-15. The table gives DELTA, the difference between the Radian NMOC concentration and the QAD NMOC concentration in ppmC; and PDELTA, the percent difference relative to the mean of the Radian and QAD analyses. ADELTA and APDELTA are the absolute values of DELTA and PDELTA, respectively. The mean percent difference shows Radian NMOC concentrations to average 4.48 percent lower than the QAD NMOC concentration. This is an average bias figure for the Radian analyses relative to a mean NMOC concentration. The average absolute percent difference is 14.07, which is a measure of the precision.

In 1986, the mean percent differences showed Radian concentrations to average 3.77% lower than the QAD NMOC concentration. The average absolute percent difference was 14.84%, relative to the mean of the Radian and QAD NMOC concentrations. The agreement between the 1986 and 1987 precision results is good, and shows that the instruments and operating procedures were consistent for the two years.

Summary statistics are given for the same data in Table 4-16 by Radian channel, and show a mean absolute percent difference ranging from 12.46 for Channel D to 14.88 for Channel A. The mean percent differences range from -10.33% for Channel A to +0.35 percent for Channel C.

Table 4-17 summarizes statistics for comparative analyses for Radian channels versus ASRL channels. DELTA is the difference between the NMOC values determined by Radian channels and the NMOC values determined by ASRL.

PDELTA averages 8.37%, indicating that DELTA is not symmetrical about zero. APDELTA is 15.88%, which is higher than the APDELTA mean for 1986, which was 12.35%. Table 4-18 compares Radian NMOC analyses with ASRL NMOC analyses, by Radian channels. APDELTA are 15.50%, 15.14%, 18.37%, and 15.36% comparing the ASRL channel with Radian Channels A, B, C, and D, respectively.

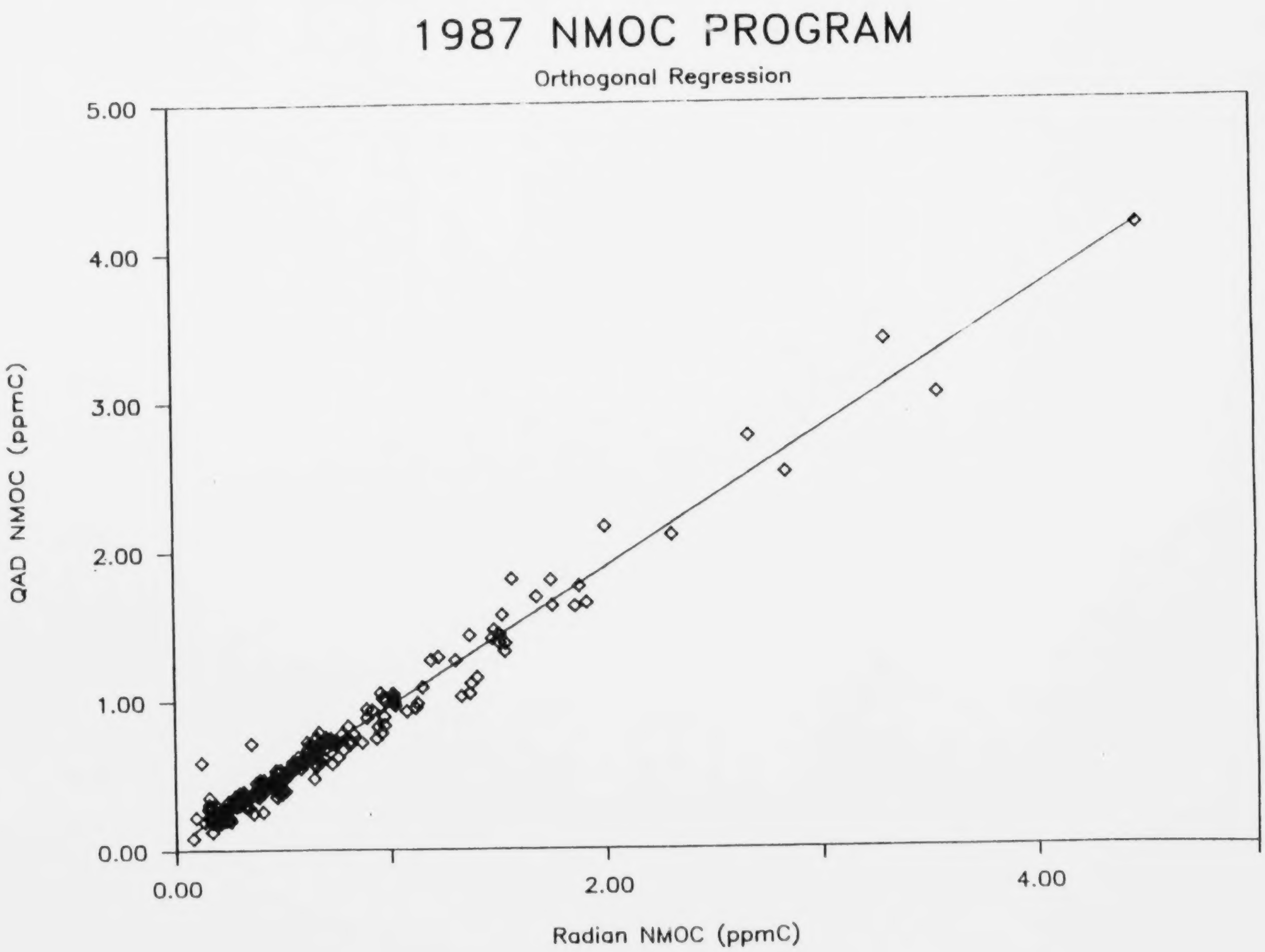

Figure 4-22. Orthogonal regression comparing QAD with Radian NMOC analyses.

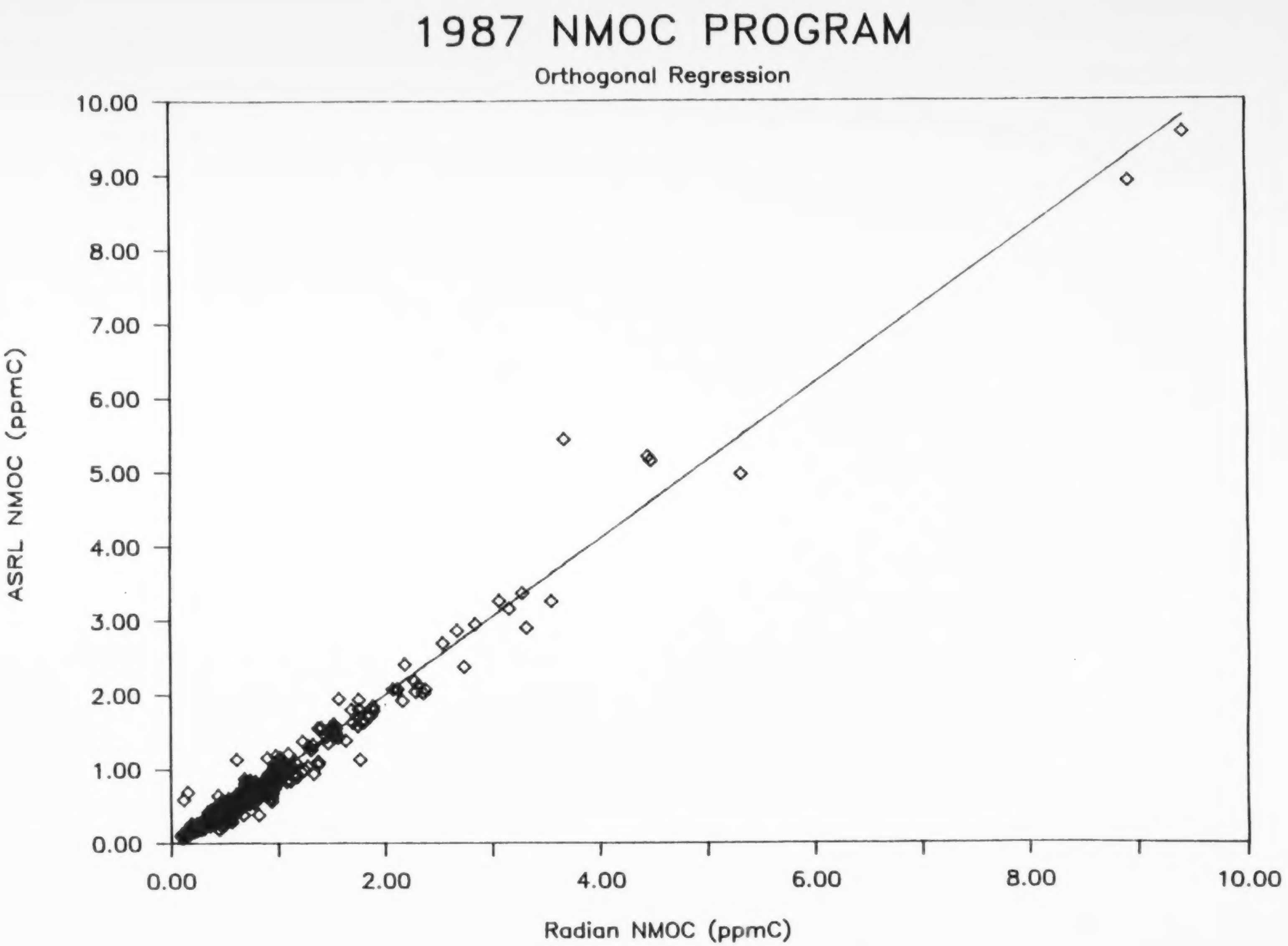

Figure 4-23. Orthogonal regression comparing ASRL with Radian NMOC analyses.

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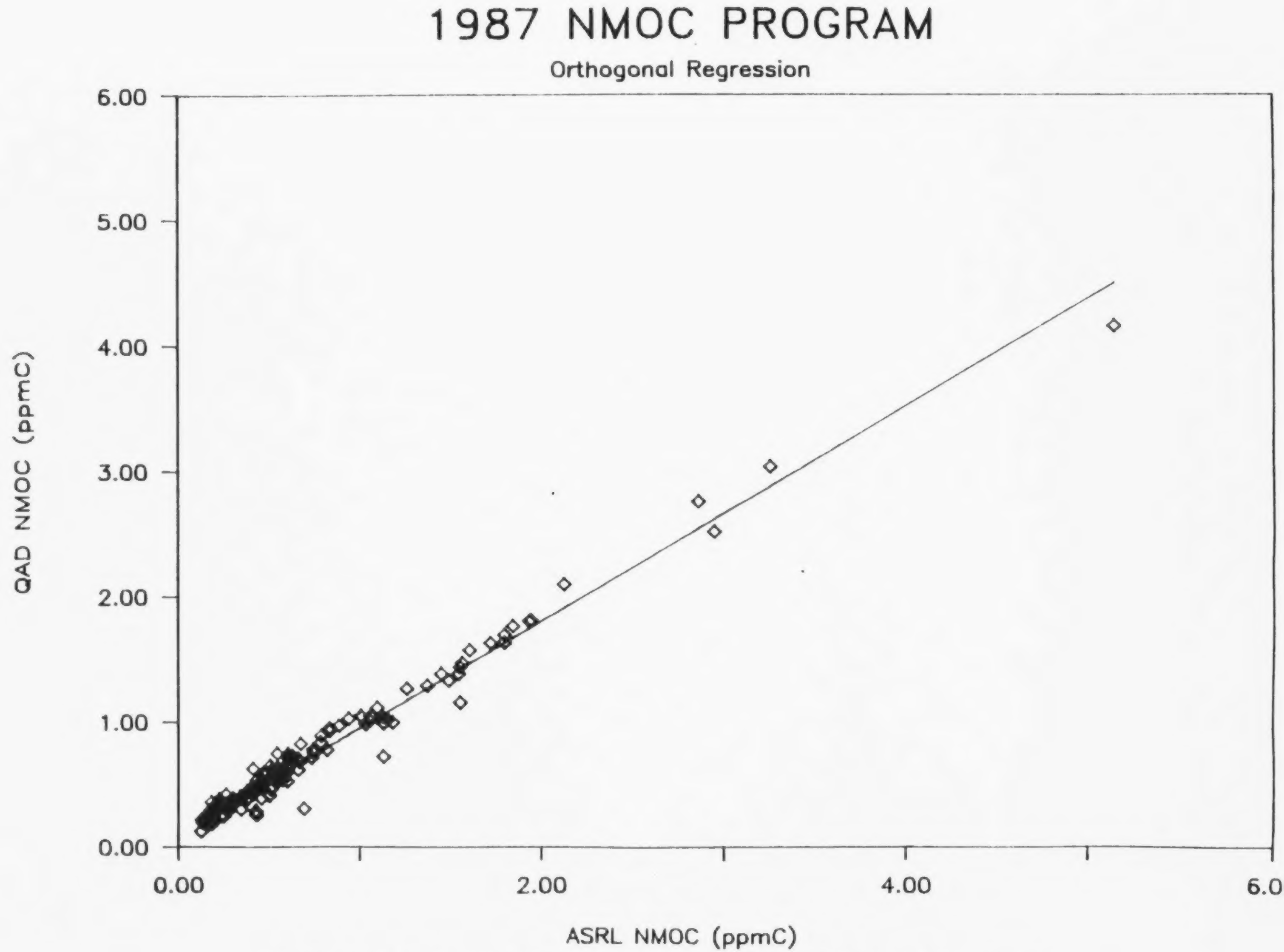

Figure 4-24. Orthogonal regression comparing ASRL with QAD NMOC analyses.

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TABLE 4-14. ORTHOGONAL REGRESSION PARAMETERS FOR REPEATED ANALYSES OF SITE SAMPLES

Channel Pair	Cases	Intercept	Slope	Coefficient of Correlation
QAD-Radian	144	0.05315	0.92725	0.97848
ASRL-Radian	306	-0.08213	1.04687	0.98823
ASRL-QAD	132	0.09686	0.85714	0.98797

TABLE 4-15. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR RADIAN VS. QAD CHANNELS

	Variables			
Statistics	DELTA[a]	ADELTA[b]	PDELTA[c]	APDELTA[d]
Cases	192	192	192	192
Minimum	-0.47000	0.00100	-132.02247	0.09799
Maximum	0.51100	0.51100	44.98480	132.02247
Mean	0.00488	0.07515	-4.48028	14.06780
Std. Dev.	0.11074	0.08130	21.04116	16.24712
Std. Error	0.00799	0.00586	1.51851	1.17253
Skewness	0.61345	2.44174	-1.91070	3.35127
Kurtosis	4.30150	7.60342	8.01716	16.62916

[a] DELTA = Radian NMOC concentration - QAD NMOC concentration, ppmC.

[b] ADELTA = Absolute value of DELTA.

[c] PDELTA = DELTA/((Radian NMOC concentration + QAD NMOC concentration)/2)x100.

[d] APDELTA = Absolute value of PDELTA.

TABLE 4-16. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR RADIAN VS. QAD CHANNELS, BY RADIAN CHANNELS

Channel	Statistics	Variables			
		DELTA[a]	ADELTA[b]	PDELTA[c]	APDELTA[d]
A	Cases	45	45	45	45
	Minimum	-0.19900	0.00100	-78.19253	0.18099
	Maximum	0.31900	0.31900	28.76712	78.19253
	Mean	-0.02826	0.07071	-10.32794	14.88330
	Std. Dev.	0.09153	0.06388	20.99133	17.97720
	Std. Error	0.01364	0.00952	3.12920	2.67988
	Skewness	1.68927	1.89985	-1.44140	2.04954
	Kurtosis	4.44741	4.39995	2.38143	3.65096
B	Cases	37	37	37	37
	Minimum	-0.36400	0.00100	-68.29268	0.25157
	Maximum	0.30100	0.36400	44.98480	68.29268
	Mean	-0.01156	0.07513	-6.73759	14.16800
	Std. Dev.	0.10823	0.07778	19.33323	14.63290
	Std. Error	0.01779	0.01278	3.17836	2.40563
	Skewness	0.01852	2.18772	-0.53058	1.88278
	Kurtosis	3.11132	4.90403	2.28560	3.61876
C	Cases	57	57	57	57
	Minimum	-0.47000	0.00200	-132.02247	0.51948
	Maximum	0.32200	0.47000	29.12966	132.02247
	Mean	0.02398	0.08335	0.34729	14.85040
	Std. Dev.	0.11603	0.08353	23.57417	18.20416
	Std. Error	0.01536	0.01106	3.12247	2.41120
	Skewness	-1.09813	2.30637	-3.19245	4.81966
	Kurtosis	4.78470	7.15679	15.59976	28.38844
D	Cases	53	53	53	53
	Minimum	-0.13000	0.00100	-82.27848	0.09799
	Maximum	0.51100	0.51100	36.84210	82.27848
	Mean	0.02398	0.07013	-3.13136	12.46378
	Std. Dev.	0.11591	0.09491	18.31558	13.67922
	Std. Error	0.01592	0.01303	2.51583	1.87898
	Skewness	2.14493	2.65959	-1.39101	2.75256
	Kurtosis	5.08700	7.97600	5.15779	10.96167

[a] DELTA = Radian NMOC concentration - QAD NMOC concentration, ppmC.

[b] ADELTA = Absolute value of DELTA.

[c] PDELTA = DELTA/((Radian NMOC concentration + QAD NMOC concentration)/2)x100.

[d] APDELTA = Absolute value of PDELTA.

TABLE 4-17. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR RADIAN VS. ASRL CHANNELS

	Variables			
Statistics	DELTA[a]	ADELTA[b]	PDELTA[c]	APDELTA[d]
Cases	306	306	306	306
Minimum	-1.757500	0.001810	-131.926864	0.158604
Maximum	0.641000	1.757500	84.345048	131.926864
Mean	0.034011	0.108950	8.369940	15.881842
Std. Dev.	0.184581	0.152714	21.028124	16.106138
Std. Error	0.010552	0.008730	1.202098	0.920727
Skewness	-3.625775	5.290134	-1.485333	3.179495
Kurtosis	30.991732	45.824318	11.742900	16.432695

[a] DELTA = Radian NMOC concentration - ASRL NMOC concentration, ppmC.

[b] ADELTA = Absolute value of DELTA.

[c] PDELTA = DELTA/((Radian NMOC concentration + ASRL NMOC concentration)/2) x100

[d] APDELTA = Absolute value of PDELTA.

TABLE 4-18. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR RADIAN VS. ASRL CHANNELS, BY RADIAN CHANNELS

		Variables			
Channel	Statistics	DELTA[a]	ADELTA[b]	PDELTA[c]	APDELTA[d]
A	Cases	61	61	61	61
	Minimum	-0.768000	0.004000	-126.415094	0.193143
	Maximum	0.298000	0.768000	32.415902	126.415094
	Mean	-0.022564	0.110236	3.001502	15.500117
	Std. Dev.	0.189982	0.155744	23.612804	17.957333
	Std. Error	0.024325	0.019941	3.023310	2.299201
	Skewness	-2.082197	2.657199	-2.904020	4.140821
	Kurtosis	5.367350	7.024766	13.420767	22.403009
B	Cases	66	66	66	66
	Minimum	-1.757500	0.001810	-38.658235	0.198216
	Maximum	0.431500	1.757500	71.886714	71.886714
	Mean	0.016908	0.095746	9.902209	15.143079
	Std. Dev.	0.243266	0.223965	18.925036	14.995950
	Std. Error	0.029944	0.027568	2.329511	1.845874
	Skewness	-5.845160	6.414825	0.707757	1.755808
	Kurtosis	41.492289	44.488754	1.815701	2.997532
C	Cases	90	90	90	90
	Minimum	-0.751000	0.002400	-131.926864	0.158604
	Maximum	0.641000	0.751000	70.655271	131.926864
	Mean	0.062343	0.124261	11.010885	18.373748
	Std. Dev.	0.172027	0.133826	23.564300	18.343670
	Std. Error	0.018133	0.014107	2.483895	1.933593
	Skewness	-1.065492	2.238971	-2.196936	3.121566
	Kurtosis	6.406699	6.313511	13.689663	15.250867
D	Cases	89	89	89	89
	Minimum	-0.208000	0.002000	-38.305709	0.301659
	Maximum	0.374000	0.374000	84.345048	84.345048
	Mean	0.056819	0.102376	8.242522	14.171414
	Std. Dev.	0.126683	0.093347	17.244796	12.766482
	Std. Error	0.013428	0.009895	1.827945	1.353244
	Skewness	0.378469	1.145351	0.806988	2.385450
	Kurtosis	0.147615	0.442802	3.585417	9.201223

[a] DELTA = Radian NMOC concentration - ASRL NMOC concentration, ppmC.

[b] ADELTA = Absolute value of DELTA.

[c] PDELTA = DELTA/((Radian NMOC concentration + ASRL NMOC concentration)/2)x100.

[d] APDELTA = Absolute value of PDELTA.

PDELTA averages are 3.00%, 9.90%, 11.01%, and 8.24% for ASRL versus Radian Channels A, B, C, and D, respectively. PDELTA means in 1986 were -2.84, -2.47, 4.55, and -1.31 for Channels A, B, C, and D, respectively. The significant differences between the PDELTA values for 1986 and 1987 indicate that the ASRL measurements for 1987 are biased relative to the Radian measurements.

Table 4-19 gives a comparison of repeated analyses of site samples by the EPA-ASRL GC/FID instrument and the EPA-QAD PDFID instrument. The results show that PDELTA averaged -9.01%, while APDELTA averaged 17.17%. It is seen that the ASRL concentrations average 9.01% lower than the QAD concentrations. Radian concentrations were 4.48% lower than QAD concentrations. APDELTA between ASRL and QAD concentrations averaged 17.17%, whereas APDELTA for Radian and QAD concentrations averaged 14.07%.

Of NMOC concentration measurements, the comparison between Radian and the EPA-QAD channel represents between-laboratory comparisons for the PDFID method. Comparisons between the Radian channels and the EPA-ASRL channel are between-laboratory and between-method comparisons.

Table 4-20 gives summary statistics for repeated analyses on Radian channels. The QAPP[1] specified the channel pair to be involved with the repeated analysis each day. The mean APDELTA was the average percent difference between the second and the first analysis and was 9.61 percent for the overall data set. Table 4-21 shows the statistics for repeated analyses by Radian channel pairs. Table 4-22 gives the 95% confidence intervals for the mean differences by channel pairs. Figure 4-25 plots the means and 95 percent confidence intervals listed in Table 4-22. The squares on Figure 4-25 locate the mean difference for each channel pair. The vertical lines span the 95% confidence intervals of the mean differences.

4.2.3.2 Local Ambient Samples. Table 4-23 presents the overall statistics for local ambient samples. These data include comparisons among Radian channels and EPA channels. The mean differences and the mean percent differences are both near zero, which indicates that they are random variables. The overall mean absolute percent difference (APDIF) is 5.58% which is lower than the precision for repeated analyses (9.61%).

Table 4-24 presents the same information separated into two cases, by the Radian analysis order. The upper part of Table 4-24 shows statistics for

TABLE 4-19. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR ASRL VS. QAD CHANNELS

	Variables			
Statistics	DELTA[a]	ADELTA[b]	PDELTA[c]	APDELTA[d]
Cases	132	132	132	132
Minimum	-0.216000	0.000000	-65.441176	0.000000
Maximum	0.986000	0.986000	77.354709	77.354709
Mean	-0.004803	0.092333	-9.009571	17.170390
Std. Dev.	0.142370	0.108176	21.278001	15.410142
Std. Error	0.012392	0.009415	1.852012	1.341281
Skewness	3.291350	5.029842	0.323309	1.368669
Kurtosis	17.542419	35.133429	1.860614	1.534560

[a] DELTA = ASRL NMOC concentration - QAD NMOC concentration, ppmC.

[b] ADELTA = Absolute value of DELTA.

[c] PDELTA = DELTA/((ASRL concentration + QAD concentration)/2)x100.

[d] APDELTA = Absolute value of PDELTA.

TABLE 4-20. SUMMARY STATISTICS FOR COMPARATIVE ANALYSES ON RADIAN CHANNELS

	Variable			
Statistics	DELTA[a]	ADELTA[b]	PDELTA[c]	APDELTA[d]
Cases	157	157	157	157
Minimum	-0.422330	0.000170	-64.994030	0.025420
Maximum	0.531250	0.531250	85.289990	85.289990
Mean	-0.024785	0.061590	-3.719633	9.612926
Std. Dev.	0.097082	0.078899	15.347544	12.508831
Std. Error	0.007748	0.006297	1.223867	0.998313
Skewness	0.369047	2.558255	0.172209	3.137740
Kurtosis	7.687498	9.474435	9.687963	12.589367

[a] DELTA = (NMOC concentration on Channel Y) - (NMOC concentration on Channel X).

[b] ADELTA = Absolute value of DELTA.

[c] PDELTA = DELTA/((NMOC concentration determined by Channel Y + NMOC concentration determined by Channel X)/2)x100.

[d] APDELTA = Absolute value of ADELTA.

TABLE 4-21. SUMMARY STATISTICS FOR COMPARATIVE ANALYSES ON RADIAN CHANNELS, BY CHANNEL PAIRS

Channel Pair[a]	Statistics	Variable			
		DELTA[b]	ADELTA[c]	PDELTA[d]	APDELTA[e]
A-A	Cases	20	20	20	20
	Minimum	-0.215670	0.000600	-19.173210	0.133070
	Maximum	0.075670	0.215670	14.049590	19.173210
	Mean	-0.014520	0.030747	-2.402161	5.130710
	Std. Dev.	0.055410	0.047927	7.416498	5.776578
	Std. Error	0.012390	0.010717	1.658379	1.291682
	Skewness	-2.314638	3.074736	-0.444377	1.323117
	Kurtosis	7.091910	9.378581	0.933168	0.630554
B-A	Cases	13	13	13	13
	Minimum	-0.103500	0.001000	-15.362530	0.284230
	Maximum	0.531250	0.531250	85.289990	85.289990
	Mean	0.034097	0.064532	4.775353	11.798633
	Std. Dev.	0.153826	0.142865	25.450508	22.839096
	Std. Error	0.042664	0.039624	7.058701	6.334426
	Skewness	2.844849	2.985396	2.654473	2.829963
	Kurtosis	6.915344	7.298912	6.117974	6.707108
B-B	Cases	11	11	11	11
	Minimum	-0.151330	0.000330	-11.853790	0.122170
	Maximum	0.015000	0.151330	3.401360	11.853790
	Mean	-0.025773	0.028560	-3.367082	4.007724
	Std. Dev.	0.044568	0.042658	4.562505	3.952137
	Std. Error	0.013438	0.012862	1.375647	1.191614
	Skewness	-2.212350	2.408757	-0.563109	0.892378
	Kurtosis	4.036074	4.601940	-0.608478	-0.496483
C-A	Cases	21	21	21	21
	Minimum	-0.229000	0.004050	-63.261300	1.514160
	Maximum	0.121950	0.229000	24.231460	63.261300
	Mean	-0.052386	0.098511	-9.952177	17.504975
	Std. Dev.	0.107201	0.064682	21.921340	16.211043
	Std. Error	0.023393	0.014115	4.783629	3.537540
	Skewness	0.114084	0.214553	-0.870703	1.791698
	Kurtosis	-1.143398	-0.775350	0.700013	2.512840
C-B	Cases	14	14	14	14
	Minimum	-0.422330	0.005670	-30.923590	1.867110
	Maximum	0.125000	0.422330	6.287020	30.923590
	Mean	-0.071594	0.103000	-5.519761	8.865784
	Std. Dev.	0.140093	0.117137	10.621641	7.809114
	Std. Error	0.037442	0.031306	2.838753	2.087073
	Skewness	-1.057384	1.491966	-0.887089	1.729007
	Kurtosis	0.807650	1.858876	0.249183	2.528654

(continued)

TABLE 4-21. Continued

Channel Pair[a]	Statistics	Variable			
		DELTA[b]	ADELTA[c]	PDELTA[d]	APDELTA[e]
C-C	Cases	10	10	10	10
	Minimum	-0.034330	0.000830	-19.865000	0.066770
	Maximum	0.120500	0.120500	16.262040	19.865000
	Mean	0.036984	0.044716	1.979921	5.984755
	Std. Dev.	0.054450	0.047570	9.318126	7.168412
	Std. Error	0.017219	0.015043	2.946650	2.266851
	Skewness	0.469887	0.618982	-1.019144	0.925325
	Kurtosis	-1.272074	-1.301231	1.459796	-0.511029
C-D	Cases	18	18	18	18
	Minimum	-0.145000	0.000170	-41.428570	0.025420
	Maximum	0.086000	0.145000	21.882950	41.428570
	Mean	-0.012889	0.040605	13.741045	10.098673
	Std. Dev.	0.058261	0.040605	13.741045	10.098673
	Std. Error	0.013732	0.009571	3.238795	2.380280
	Skewness	-0.625618	1.021460	-0.924524	1.852659
	Kurtosis	-0.095392	0.283705	1.576549	3.402549
D-A	Cases	25	25	25	25
	Minimum	-0.272000	0.000170	-64.994030	0.057160
	Maximum	0.016830	0.272000	6.031650	64.994030
	Mean	-0.065787	0.070267	-9.359777	10.807746
	Std. Dev.	0.087663	0.083963	15.136394	14.095806
	Std. Error	0.017533	0.016793	3.027279	2.819161
	Skewness	-1.210417	1.320136	-2.225807	2.599926
	Kurtosis	0.257592	0.448797	5.567505	7.063711
D-B	Cases	16	16	16	16
	Minimum	-0.162500	0.002330	-25.477370	0.605270
	Maximum	0.110000	0.162500	16.860990	25.477370
	Mean	-0.021393	0.060207	-2.435225	8.213131
	Std. Dev.	0.079434	0.054142	10.956107	7.376272
	Std. Error	0.019858	0.013536	2.739027	1.844068
	Skewness	-0.335253	0.762909	-0.351193	0.948399
	Kurtosis	-0.497303	-0.656490	-0.167995	-0.140008

(continued)

TABLE 4-21. Continued

Channel Pair[a]	Statistics	Variable			
		DELTA[b]	ADELTA[c]	PDELTA[d]	APDELTA[e]
D-D	Cases	9	9	9	9
	Minimum	-0.120500	0.002000	-15.095520	0.511950
	Maximum	0.224500	0.224500	38.824040	38.824040
	Mean	0.021222	0.050851	4.873522	8.925544
	Std. Dev.	0.089343	0.074698	14.597602	12.255064
	Std. Error	0.029781	0.024899	4.865867	4.085021
	Skewness	1.023254	1.642216	1.303564	1.791302
	Kurtosis	1.662026	1.295727	1.621283	2.094630

[a] Pairs X-Y = Channel pair.

[b] DELTA = (NMOC concentration on Channel X) - (NMOC concentration on Channel Y).

[c] ADELTA = Absolute value of DELTA.

[d] PDELTA = DELTA/((NMOC concentration determined by Channel X + NMOC concentration determined by Channel Y)/2)x100.

[e] APDELTA = Absolute value of PDELTA.

TABLE 4-22. 95% CONFIDENCE INTERVALS FOR MEAN DELTA, REPEATED ANALYSES

		Mean Difference, ppmC					
						95% Confidence Interval	
Pair No.	Channel Pair	Mean Difference	Standard Deviation	Cases	$t_{0.975,n-1}$[b]	Upper	Lower
1	A-A	-0.015	0.055	20	2.093	0.01074	-0.04074
2	B-B	-0.026	0.045	11	2.228	0.00423	-0.05623
3	C-C	0.037	0.054	10	2.262	0.07563	-0.00163
4	D-D	0.021	0.089	9	2.306	0.08941	-0.04741
5	B-A	0.034	0.154	13	2.179	0.12707	-0.05907
6	C-A	-0.052	0.107	21	2.086	0.00329	-0.10071
7	D-A	-0.066	0.088	25	2.064	-0.02967	-0.10233
8	C-B	-0.072	0.140	14	2.160	0.00882	-0.15282
9	D-B	-0.021	0.079	16	2.131	0.02109	-0.06309
10	C-D	-0.013	0.060	18	2.110	0.01684	-0.04284

[a] n = the number of data points in the mean DELTA.

[b] $t_{0.975,n-1}$ = Student's t-statistic for 95% confidence interval

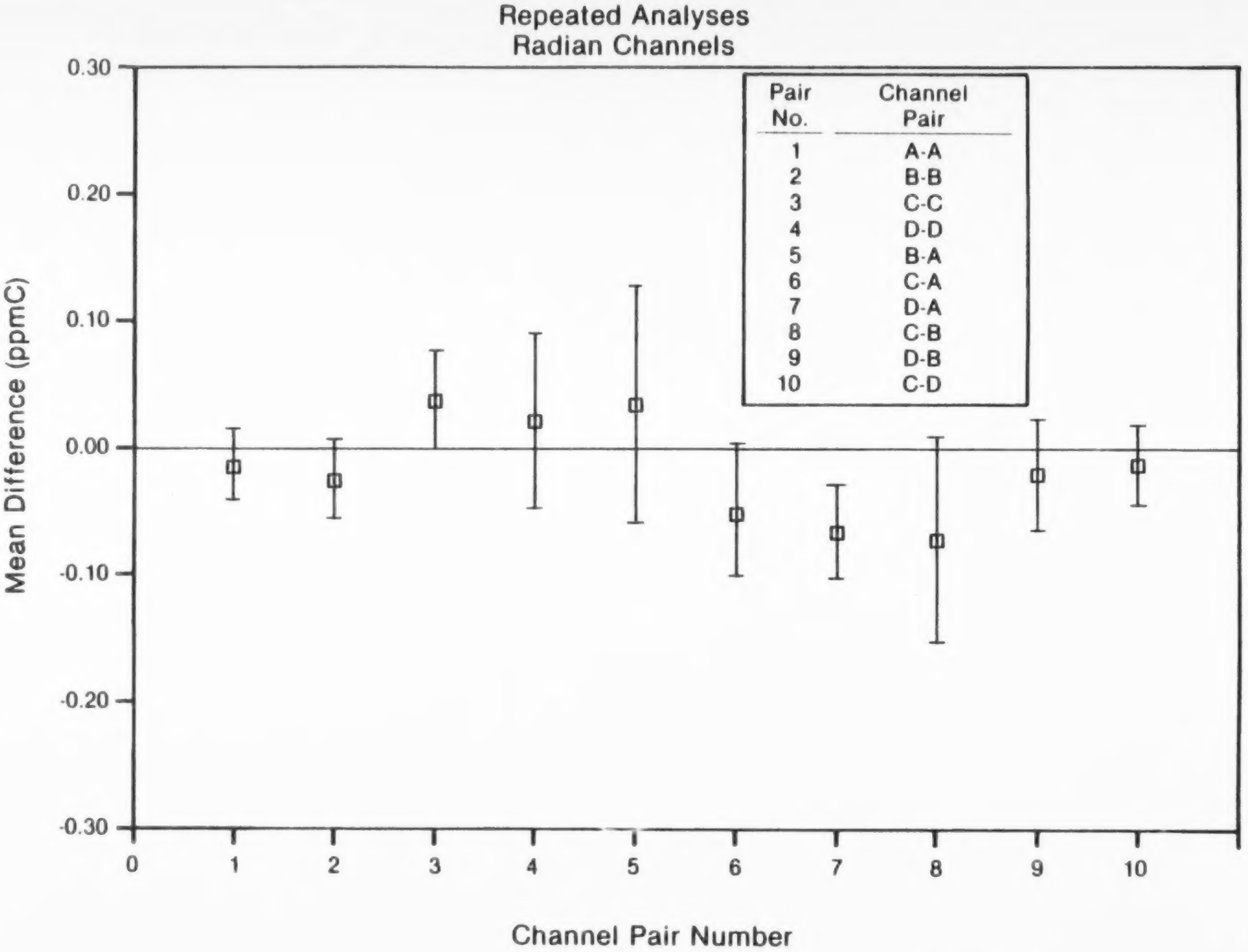

Figure 4-25. 95% Confidence intervals for mean NMOC difference.

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TABLE 4-23. OVERALL STATISTICS FOR LOCAL AMBIENT SAMPLES

Statistics	Variables			
	DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
Cases	230	230	230	230
Minimum	-0.82500	0.00000	-24.54308	0.00000
Maximum	0.36300	0.82500	20.42254	24.54308
Mean	-0.00731	0.04677	1.58961	5.58342
Std. Dev.	0.10690	0.09636	7.10270	4.65569
Std. Error	0.00705	0.00635	0.46834	0.30699
Skewness	-3.73084	5.06770	-0.27716	1.38459
Kurtosis	25.02664	29.71466	1.12615	2.24271

[a] DIF = (NMOC concentration for the second channel) - (NMOC concentration for first channel), ppmC.

[b] ADIF = Absolute value of DIF.

[c] PDIF = DIF/((NMOC concentration, first channel + NMOC concentration, second channel)/2)x100.

[d] APDIF = Absolute value of PDIF.

TABLE 4-24. OVERALL STATISTICS FOR LOCAL AMBIENT SAMPLES, BY RADIAN ANALYSIS ORDER

Radian Analysis Order	Statistics	Variables			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
First[e]	Cases	120	120	120	120
	Minimum	-0.82500	0.00000	-24.54308	0.00000
	Maximum	0.36300	0.82500	19.94885	24.54308
	Mean	-0.02110	0.06105	0.23123	4.92670
	Std. Dev.	0.14130	0.12906	6.75425	4.60408
	Std. Error	0.01290	0.01178	0.61658	0.42029
	Skewness	-2.82900	3.73300	-0.74620	1.83261
	Kurtosis	13.53731	14.89656	2.18676	4.44268
Second[f]	Cases	110	110	110	110
	Minimum	-0.15200	0.00000	-13.44307	0.00000
	Maximum	0.12200	0.15200	20.42254	20.42254
	Mean	0.00774	0.03119	3.07148	6.29985
	Std. Dev.	0.04212	0.02920	7.20659	4.62638
	Std. Error	0.00402	0.00278	0.68712	0.44111
	Skewness	-0.76266	1.67820	0.03579	0.99422
	Kurtosis	2.35709	3.20571	-0.15722	0.60278

[a] DIF = (NMOC concentration for the second channel) - (NMOC concentration for the first channel), ppmC.

[b] ADIF = Absolute value of DIF.

[c] PDIF = DIF/((NMOC concentration, first channel) + NMOC concentration, second channel)/2)x100.

[d] APDIF = Absolute value of PDIF for comparisons involving Radian Channels A, B, C, D, QAD, and ASRL.

[e] "First" Radian analysis order describes those local ambient samples analyzed first by Radian channels and secondly by EPA channels.

[f] "Second" Radian analysis order describes those local ambient samples analyzed first by EPA channels and secondly by Radian channels.

the local ambient sample analyzed first by Radian. The lower part of Table 4-24 shows statistics for the local ambient sample analyzed first by the EPA laboratories, Channels QAD and ASRL. In Table 4-24, two sets of statistics for APDIF are shown. In the first set, footnote "d" indicates that all Radian Table 4-23 channels (A, B, C, and D) and both EPA channels (ASRL and QAD) are included.

Table 4-25 shows statistics for local ambient samples by analysis order and channel pair. Mean absolute percent differences range from 0.85% for Radian Channel Pair B-A for Radian first analysis order to 12.00 percent for Channel Pair ASRL-3 for Radian second analysis order, averaging 5.58% overall.

Tables 4-26 and 4-27 use data extracted from Table 4-25 and add the 95% confidence intervals for the mean values of DIF. For example, from the Table 4-26, for the channel pair B-A, the mean DIF is -0.008 ppmC, indicating that the average the NMOC concentration determined for the local ambient samples was larger for Channel A than for Channel B by 0.008 ppmC. Figures 4-26 and 4-27 display the data from Tables 4-26 and 4-27 graphically and indicate no significant difference, at the 0.05 level of significance between the channel pair mean differences and zero. The channel pairs containing QAD for Figure 4-26 show mean differences greater than zero.

Table 4-28 presents comparisons between percent differences in NMOC concentrations for all channel pairs. Overall trends in the data are difficult to discern with the exception of the fact that the standard deviations of the differences for the site samples are larger than the corresponding mean differences. This is true for 29 out of 30 comparisons for the local ambient samples.

4.2.4 Duplicate Site Sample Results

Throughout the 1987 NMOC monitoring program, duplicate samples were collected once every two weeks at each site. Each duplicate was analyzed by Radian for its NMOC content. The results for the NMOC duplicate analyses are given in Section 4.2.4.1.

Table 4-29 summarizes statistics for NMOC, DIFF, ADIFF, PCDIFF, and APCDIFF. The mean absolute percent difference between the duplicate samples was 15.4%. The range of the absolute percent difference was from zero to 173%. Table 4-30 summarizes the statistics for duplicate analyses by site

TABLE 4-25. STATISTICS FOR LOCAL AMBIENT SAMPLES, BY RADIAN ANALYSES ORDER AND CHANNEL PAIR

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
First/ ASRL-A	Cases	6	6	6	6
	Minimum	-0.643000	0.001000	-15.384615	0.246609
	Maximum	0.030000	0.643000	10.989011	15.384615
	Mean	-0.110000	0.123667	-1.482348	6.292517
	Std. Dev.	0.262675	0.255276	9.054478	6.091426
	Std. Error	0.107236	0.104216	3.696475	2.486814
	Skewness	-1.742684	1.762440	-0.250464	0.400449
	Kurtosis	1.113380	1.151227	-0.740415	-1.280572
First/ ASRL-B	Cases	6	6	6	6
	Minimum	-0.549000	0.000000	-15.089163	0.000000
	Maximum	0.037000	0.549000	13.381555	15.089163
	Mean	-0.092667	0.109000	0.741377	6.475781
	Std. Dev.	0.225574	0.216635	9.569475	6.473911
	Std. Error	0.092090	0.088441	3.906722	2.642963
	Skewness	-1.719441	1.749501	-0.053347	0.353378
	Kurtosis	1.070531	1.127899	-0.608771	-1.485875
First/ ASRL-C	Cases	6	6	6	6
	Minimum	-0.462000	0.004000	-5.279397	1.033592
	Maximum	0.038000	0.462000	9.594096	9.594096
	Mean	0.066833	0.090500	2.045537	4.805604
	Std. Dev.	0.194353	0.182496	6.134684	3.865594
	Std. Error	0.079344	0.074504	2.504474	1.578122
	Skewness	-1.757184	1.767204	0.300383	0.346459
	Kurtosis	1.144494	1.160363	-1.447411	-1.631459
First/ ASRL-D	Cases	6	6	6	6
	Minimum	-0.476000	0.001000	-5.443733	0.325203
	Maximum	0.024000	0.476000	8.888889	8.888889
	Mean	-0.073167	0.089833	1.076216	4.035464
	Std. Dev.	0.197745	0.189322	5.142999	2.880687
	Std. Error	0.080729	0.077291	2.099620	1.176036
	Skewness	-1.772796	1.782899	-0.231111	0.587983
	Kurtosis	1.171018	1.189363	-0.980855	-0.386279

(continued)

TABLE 4-25. Continued.

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
First/ ASRL-QAD	Cases	6	6	6	6
	Minimum	-0.825000	0.005000	-10.752688	1.919386
	Maximum	0.015000	0.825000	4.754358	10.752688
	Mean	-0.146333	0.153000	-3.693744	5.918325
	Std. Dev.	0.333040	0.329426	6.178693	3.537915
	Std. Error	0.135963	0.134487	2.522441	1.444348
	Skewness	-1.775310	1.783668	0.199716	0.379266
	Kurtosis	1.175676	1.190576	-1.383574	-1.386509
First/ B-A	Cases	9	9	9	9
	Minimum	-0.094000	0.001000	-2.401372	0.246609
	Maximum	0.020000	0.094000	1.463058	2.401372
	Mean	-0.008556	0.014778	-0.199768	0.845674
	Std. Dev.	0.032921	0.030339	1.126552	0.713761
	Std. Error	0.010974	0.010113	0.375517	0.237920
	Skewness	-2.209338	2.296304	-0.535256	1.232490
	Kurtosis	-3.469399	3.568224	-0.133299	0.448937
First/ C-A	Cases	9	9	9	9
	Minimum	-0.181000	0.002000	-24.543081	0.518135
	Maximum	0.016000	0.181000	5.161290	24.543081
	Mean	-0.045333	0.051333	-3.247652	5.617042
	Std. Dev.	0.068690	0.063763	8.952242	7.517528
	Std. Error	0.022897	0.021254	2.984081	2.505843
	Skewness	-0.925894	1.031746	-1.616578	2.016685
	Kurtosis	-0.485711	-0.270135	1.694582	2.719474
First/ C-B	Cases	9	9	9	9
	Minimum	-0.118000	0.003000	-24.250326	0.776197
	Maximum	0.018000	0.118000	5.787781	24.250326
	Mean	-0.036778	0.044778	-3.048284	5.990802
	Std. Dev.	0.052834	0.045359	9.152851	7.338412
	Std. Error	0.017611	0.015120	3.050950	2.446137
	Skewness	-0.382673	0.472679	-1.466781	1.924007
	Kurtosis	-1.546344	-1.435875	1.273732	2.483023
First/ C-D	Cases	9	9	9	9
	Minimum	-0.050000	0.002000	-12.345679	0.164454
	Maximum	0.017000	0.050000	4.982206	12.345679
	Mean	-0.005333	0.015778	-0.241558	3.182076
	Std. Dev.	0.021875	0.015180	5.076826	3.801118
	Std. Error	0.007292	0.005060	1.692275	1.267309
	Skewness	-1.041236	1.396802	-1.550886	1.717540
	Kurtosis	-0.119451	0.884729	1.800901	1.869988

(continued)

TABLE 4-25. Continued.

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
First/ D-A	Cases	9	9	9	9
	Minimum	-0.167000	0.002000	-12.290503	1.398601
	Maximum	0.011000	0.167000	3.520000	12.290503
	Mean	-0.040000	0.043778	-3.016760	4.266819
	Std. Dev.	0.056745	0.053516	4.642272	3.362689
	Std. Error	0.018915	0.017839	1.547424	1.120896
	Skewness	-1.312091	1.483041	-0.561159	1.672514
	Kurtosis	0.769592	1.129605	0.050286	1.720418
First/ D-B	Cases	9	9	9	9
	Minimum	-0.089000	0.003000	-11.994421	0.861916
	Maximum	0.013000	0.089000	4.506066	11.994421
	Mean	-0.031444	0.037222	-2.817060	4.739904
	Std. Dev.	0.039351	0.033199	5.187740	3.250451
	Std. Error	0.013117	0.011066	1.729247	1.083484
	Skewness	-0.284700	0.504761	-0.119179	1.202736
	Kurtosis	-1.479958	-1.454446	-0.535990	0.880333
First/ QAD-A	Cases	9	9	9	9
	Minimum	-0.016000	0.005000	-4.651163	1.312551
	Maximum	0.182000	0.182000	9.074410	9.074410
	Mean	-0.029556	0.034222	2.761816	4.142088
	Std. Dev.	0.058686	0.055760	4.503110	3.091533
	Std. Error	0.019562	0.018587	1.501037	1.030511
	Skewness	2.223830	2.416187	0.004246	0.698834
	Kurtosis	3.474253	3.960900	-0.819400	-1.066661
First/ QAD-B	Cases	9	9	9	9
	Minimum	-0.015000	0.000000	-4.354136	0.000000
	Maximum	0.276000	0.276000	11.469534	11.469534
	Mean	0.038111	0.042111	2.961004	4.135951
	Std. Dev.	0.090239	0.088216	4.831262	3.736339
	Std. Error	0.030080	0.029405	1.610421	1.245446
	Skewness	2.367277	2.421111	0.329347	0.805059
	Kurtosis	3.822906	3.970035	-0.632862	-0.353834
First/ QAD-C	Cases	9	9	9	9
	Minimum	-0.021000	0.007000	-6.720000	2.099738
	Maximum	0.363000	0.363000	19.948849	19.948849
	Mean	0.074889	0.079556	6.016092	7.509426
	Std. Dev.	0.116932	0.113412	7.048195	5.191741
	Std. Error	0.038977	0.037804	2.349398	1.730580
	Skewness	1.850041	1.962604	0.242600	1.602969
	Kurtosis	2.293453	2.563135	0.676271	1.849267

(continued)

TABLE 4-25. Continued.

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
First/ QAD-D	Cases	9	9	9	9
	Minimum	-0.016000	0.014000	-5.079365	4.188922
	Maximum	0.349000	0.349000	10.218978	10.218978
	Mean	0.069556	0.073111	5.779007	6.907755
	Std. Dev.	0.110065	0.107441	4.434198	1.884659
	Std. Error	0.036688	0.035814	1.478066	0.628220
	Skewness	2.059811	2.159606	-1.763574	0.218293
	Kurtosis	2.918796	3.159993	2.231658	-0.772645
Second/ ASRL-A	Cases	6	6	6	6
	Minimum	-0.093000	0.014000	-7.302709	4.204204
	Maximum	0.052000	0.093000	18.505338	18.505338
	Mean	0.013667	0.044667	7.765367	10.199603
	Std. Dev.	0.053902	0.027119	9.003411	5.346421
	Std. Error	0.022006	0.011071	3.675627	2.182667
	Skewness	-1.557617	0.865192	-0.585345	0.488723
	Kurtosis	0.775440	-0.141182	-0.563205	-1.074448
Second/ ASRL-B	Cases	6	6	6	6
	Minimum	-0.050000	0.021000	-3.861004	3.861004
	Maximum	0.058000	0.058000	20.422535	20.422535
	Mean	0.021500	0.038167	8.614864	9.901865
	Std. Dev.	0.037066	0.013438	7.975140	5.916552
	Std. Error	0.015132	0.005486	3.255837	2.415422
	Skewness	-1.341246	0.360779	-0.134669	0.882267
	Kurtosis	0.556622	-1.060786	-0.394876	-0.229464
Second/ ASRL-C	Cases	6	6	6	6
	Minimum	-0.152000	0.016000	-12.218650	3.874092
	Maximum	0.060000	0.152000	16.853933	16.853933
	Mean	0.008167	0.058833	7.930060	12.002944
	Std. Dev.	0.080096	0.048392	10.828458	4.453508
	Std. Error	0.032699	0.019756	4.420699	1.818137
	Skewness	-1.630048	1.355705	-1.214786	-0.988488
	Kurtosis	0.915837	0.475444	0.045953	0.044785
Second/ ASRL-D	Cases	6	6	6	6
	Minimum	-0.045000	0.003000	-3.468208	0.738007
	Maximum	0.060000	0.060000	19.469027	19.469027
	Mean	0.024333	0.039333	9.108588	10.264657
	Std. Dev.	0.040623	0.022456	9.191098	7.589473
	Std. Error	0.016584	0.009168	3.752250	3.098389
	Skewness	-0.809332	-0.759197	-0.252919	-0.047377
	Kurtosis	-0.673111	-0.994277	-1.466668	-1.574794

(continued)

TABLE 4-25. Continued.

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
Second/ ASRL-QAD	Cases	6	6	6	6
	Minimum	-0.086000	0.007000	-6.734534	1.743462
	Maximum	0.063000	0.086000	17.622378	17.622378
	Mean	0.007500	0.038500	5.632958	8.458957
	Std. Dev.	0.050922	0.029697	8.654003	5.206082
	Std. Error	0.020789	0.012124	3.532982	2.125374
	Skewness	-1.049759	0.691458	-0.165549	0.716529
	Kurtosis	0.078984	-0.978301	-0.975351	-0.027695
Second/ B-A	Cases	8	8	8	8
	Minimum	-0.043000	0.006000	-5.673759	0.398601
	Maximum	0.056000	0.056000	4.132841	5.673759
	Mean	0.000125	0.019125	-0.831063	3.291365
	Std. Dev.	0.028271	0.019526	3.786610	1.657431
	Std. Error	0.009995	0.006904	1.338769	0.585990
	Skewness	0.591347	1.121961	-0.117697	0.370310
	Kurtosis	0.412501	-0.433087	-1.530550	-1.374296
Second/ C-A	Cases	8	8	8	8
	Minimum	-0.046000	0.008000	-12.672176	1.862464
	Maximum	0.059000	0.059000	6.015038	12.672176
	Mean	0.001875	0.024125	0.397828	5.106077
	Std. Dev.	0.031823	0.018750	6.421404	3.408621
	Std. Error	0.011251	0.006629	2.270309	1.205130
	Skewness	0.251690	0.978994	-1.098632	1.430715
	Kurtosis	-0.342017	-0.538848	0.068252	1.182305
Second/ C-B	Cases	8	8	8	8
	Minimum	-0.082000	0.001000	-7.248322	0.314961
	Maximum	0.102000	0.102000	11.678832	11.678832
	Mean	0.001750	0.035000	1.225693	6.066924
	Std. Dev.	0.052399	0.036731	7.368191	3.733818
	Std. Error	0.018526	0.012986	2.605049	1.320104
	Skewness	0.415882	1.010390	0.147592	-0.330341
	Kurtosis	0.282585	-0.547062	-1.503762	-0.738352
Second/ C-D	Cases	8	8	8	8
	Minimum	-0.013000	0.000000	-4.186795	0.000000
	Maximum	0.107000	0.107000	8.759722	8.759722
	Mean	-0.018375	0.025875	1.671748	3.751281
	Std. Dev.	0.040767	0.035815	4.579727	2.843498
	Std. Error	0.014413	0.012662	1.619178	1.005328
	Skewness	1.431382	1.659955	0.240305	0.505101
	Kurtosis	0.819469	1.409758	-1.171561	-0.608246

(continued)

TABLE 4-25. Continued.

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
Second/ D-A	Cases	8	8	8	8
	Minimum	-0.072000	0.003000	-12.672176	0.972447
	Maximum	0.024000	0.072000	6.984127	12.672176
	Mean	-0.016500	0.029000	-1.274732	5.190076
	Std. Dev.	0.035214	0.024290	6.437859	3.538091
	Std. Error	0.012450	0.008588	2.276127	1.250904
	Skewness	-0.326207	0.570279	-0.331810	1.136236
	Kurtosis	-1.266337	-0.866526	-0.671047	0.648086
Second/ D-B	Cases	8	8	8	8
	Minimum	-0.128000	0.003000	-9.202013	0.392927
	Maximum	0.018000	0.128000	8.633094	9.202013
	Mean	-0.016625	0.028375	-0.444642	5.048225
	Std. Dev.	0.047809	0.041005	6.284236	3.254588
	Std. Error	0.016903	0.014497	2.221813	1.150671
	Skewness	-1.788701	2.105674	-0.067390	-0.182646
	Kurtosis	1.907439	2.737541	-1.281855	-1.203129
Second/ QAD-A	Cases	8	8	8	8
	Minimum	-0.049000	0.006000	-13.443073	0.568874
	Maximum	0.050000	0.050000	8.843537	13.443073
	Mean	0.011625	0.025625	2.623696	6.126682
	Std. Dev.	0.030052	0.017525	7.162683	4.033937
	Std. Error	0.010625	0.006196	2.532391	1.426212
	Skewness	-0.888786	0.317623	-1.534967	0.473464
	Kurtosis	0.222644	-1.338278	1.309536	-0.525107
Second/ QAD-B	Cases	8	8	8	8
	Minimum	-0.030000	0.005000	-8.021390	0.451128
	Maximum	0.036000	0.036000	10.774411	10.774411
	Mean	0.011500	0.020500	3.452024	5.570154
	Std. Dev.	0.021948	0.012352	6.116118	3.945470
	Std. Error	0.007760	0.004367	2.162374	1.394934
	Skewness	-0.711771	-0.076581	-0.567032	0.050485
	Kurtosis	-0.415888	-1.643595	-0.364430	-1.465159
Second/ QAD-C	Cases	8	8	8	8
	Minimum	-0.066000	0.002000	-5.495420	0.774194
	Maximum	0.076000	0.076000	7.445443	7.445443
	Mean	0.009750	0.027500	2.226032	4.178051
	Std. Dev.	0.039604	0.028511	4.408755	2.269447
	Std. Error	0.014002	0.010080	1.558730	0.802371
	Skewness	-0.339537	0.854837	-0.566543	-0.212321
	Kurtosis	0.477603	-0.853098	-0.908528	-1.100343

(continued)

TABLE 4-25. Continued.

Radian Analysis Order/Pair	Statistics	Variable			
		DIF[a]	ADIF[b]	PDIF[c]	APDIF[d]
Second/ QAD-D	Cases	8	8	8	8
	Minimum	-0.003000	0.001000	-0.774194	0.328407
	Maximum	0.122000	0.122000	9.813875	9.813875
	Mean	0.028125	0.029125	3.897432	4.173082
	Std. Dev.	0.041087	0.040283	4.015169	3.684988
	Std. Error	0.014526	0.014242	1.419577	1.302840
	Skewness	1.653020	1.718849	0.340048	0.509223
	Kurtosis	1.578668	1.724123	-1.332369	-1.326902

[a] DIF = (NMOC concentration for the second channel) - (NMOC concentration for first channel), ppmC.

[b] ADIF = absolute value of ADIF.

[c] PDIF = DELTA/(NNMOC concentration, first channel) + (NMOC concentration, second channel)/2x100.

[d] APDIF = Absolute value of PDIF

TABLE 4-26. LOCAL AMBIENT SAMPLES, RADIAN FIRST ANALYSIS

Pair No.	Channel Pair	Mean Difference (ppmC)	Standard Deviation (ppmC)	Cases	$t_{0.975,n-1}$	95% Confidence Interval Upper	95% Confidence Interval Lower
1	B-A	-0.008	0.033	9	2.306	0.017	-0.033
2	C-A	-0.045	0.069	9	2.306	0.008	-0.098
3	D-A	-0.040	0.057	9	2.306	0.004	-0.084
4	QAD-A	0.030	0.059	9	2.306	0.075	-0.015
6	C-B	-0.037	0.053	9	2.306	0.004	-0.078
7	D-B	-0.031	0.039	9	2.306	-0.001	-0.061
8	QAD-B	0.038	0.090	9	2.306	0.107	-0.031
10	C-D	-0.005	0.022	9	2.306	0.012	-0.022
11	QAD-C	0.075	0.117	9	2.306	0.165	-0.015
13	QAD-D	0.070	0.110	9	2.306	0.255	-0.015

$t_{0.975,\ n-1}$ = Student's t-statistic for 95% confidence interval, where n = the number of cases in mean DIF.

TABLE 4-27. LOCAL AMBIENT SAMPLES, RADIAN SECOND ANALYSIS

Pair No.	Channel Pair	Mean Difference (ppmC)	Standard Deviation (ppmC)	Cases	$t_{0.975,n-1}$	95% Confidence Interval Upper	95% Confidence Interval Lower
1	B-A	0.000	0.028	8	2.365	0.023	-0.023
2	C-A	0.002	0.032	8	2.365	0.029	-0.025
3	D-A	-0.016	0.035	8	2.365	0.013	-0.045
4	QAD-A	0.012	0.030	8	2.365	0.037	-0.013
6	C-B	0.002	0.052	8	2.365	0.045	-0.041
7	D-B	-0.017	0.048	8	2.365	0.023	-0.057
8	QAD-B	0.012	0.022	8	2.365	0.030	-0.006
10	C-D	0.018	0.041	8	2.365	0.052	-0.016
11	QAD-C	0.010	0.040	8	2.365	0.043	-0.023
13	QAD-D	0.028	0.041	8	2.365	0.062	-0.006

$t_{0.975,\ n-1}$ = Student's t-statistic for 95% confidence interval, where n = the number of cases in mean DIF.

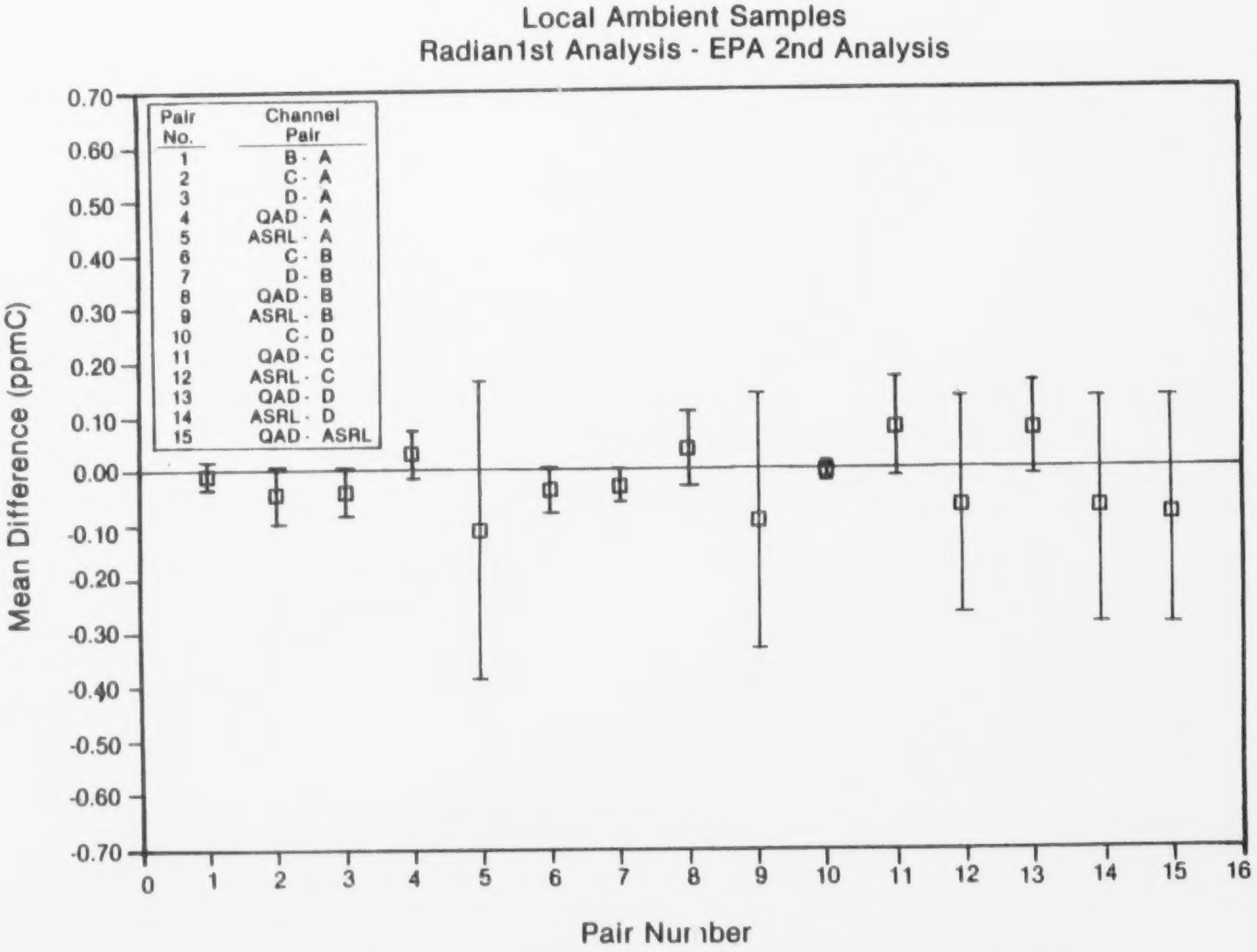

Figure 4-26. 95% Confidence intervals for mean NMOC difference, Radian first analysis

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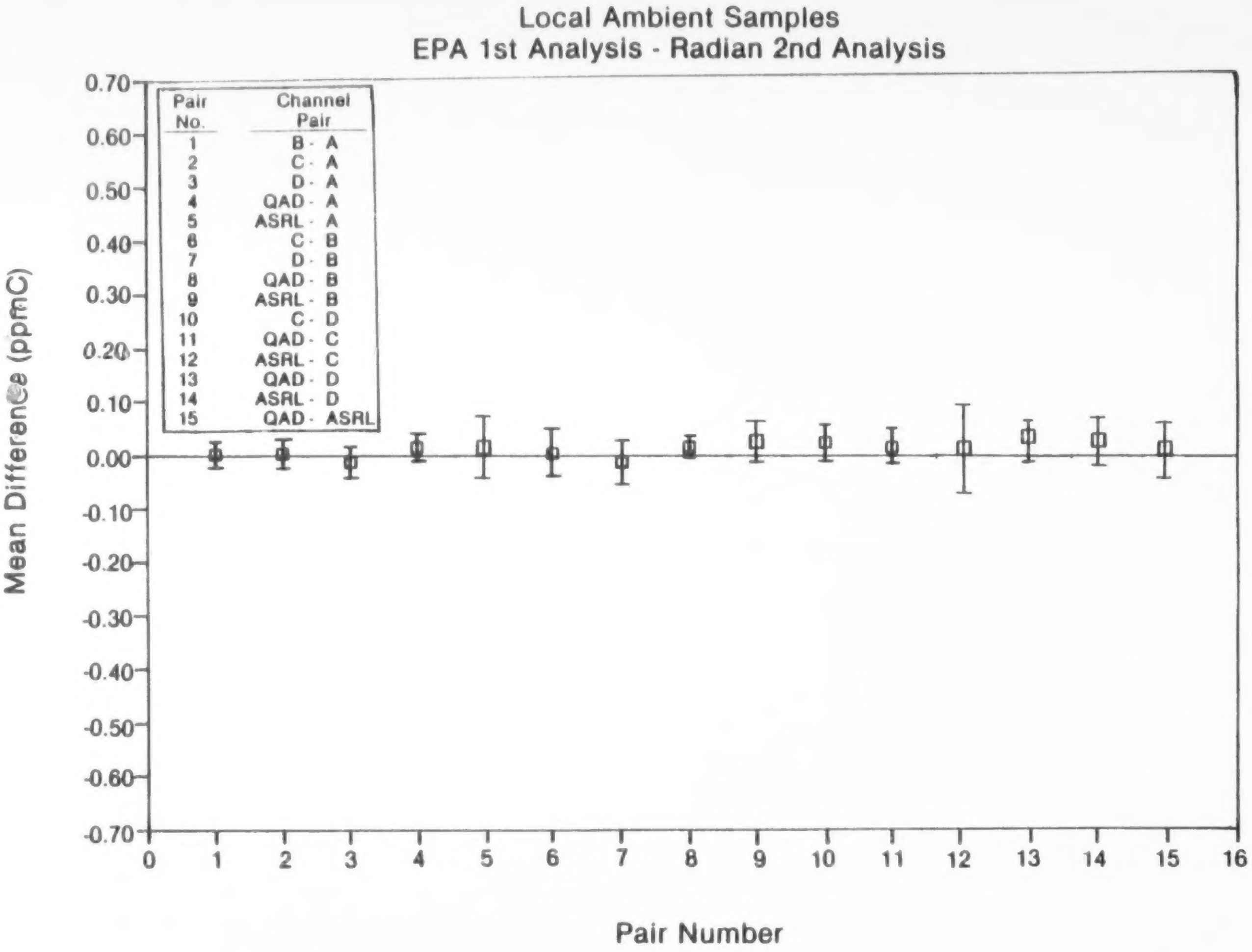

Figure 4-27. 95% Confidence intervals for mean NMOC difference, EPA first analysis.

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TABLE 4-28. COMPARISON OF PERCENT DIFFERENCE IN NMOC CONCENTRATION BETWEEN CHANNEL PAIRS[a]

				Local Ambient Samples					
	Site Samples			Duplicate No. 1			Duplicate No. 2		
	Percent Difference			Percent Difference			Percent Difference		
Channel Pair	Mean	Standard Deviation	Cases	Mean	Standard Deviation	Cases	Mean	Standard Deviation	Cases
Radian vs. Radian									
B-A	4.775353	25.450508	13	-0.199768	1.126552	9	-0.831063	3.786610	8
C-A	-9.952177	21.921340	21	-3.247652	8.952242	9	0.397828	6.421404	8
D-A	-9.359777	15.136394	25	-3.016760	4.642272	9	-1.274732	6.437859	8
C-B	-5.519761	10.621641	14	-3.048284	9.152851	9	1.225693	7.368191	8
D-B	-2.435225	10.956107	16	-2.817558	5.187740	9	-0.444642	6.284236	8
C-D	-3.633962	13.741045	18	-0.241558	5.076826	9	1.671748	4.579727	8
Overall	-3.719633	15.347544	157	-2.095180	6.159991	54	0.124139	5.719381	48
ASRL vs. Radian									
ASRL-A	3.001502	23.612804	61	-1.482348	9.054478	6	7.765367	9.003411	6
ASRL-B	9.902209	18.925036	66	-0.741377	9.569475	6	8.614864	7.975140	6
ASRL-C	11.010885	23.564300	90	2.045537	6.134684	6	7.930060	10.828458	6
ASRL-D	8.242522	17.244796	89	1.076216	5.142999	6	9.108588	9.191098	6
Overall	8.369940	21.028124	306	0.224507	7.707840	24	8.354719	9.305859	24
QAD vs. Radian									
QAD-A	-10.327947	20.991339	45	2.761816	4.503110	9	2.901161	53.049752	6
QAD-B	-6.737596	19.333231	37	2.961004	4.831262	9	3.848494	54.315249	6
QAD-C	0.347299	23.574175	57	6.016092	7.048195	9	3.170597	54.491644	6
QAD-D	-3.131360	18.315582	53	5.779007	4.434198	9	4.531125	56.390402	6
Overall	-4.480285	21.041160	192	4.379480	5.310531	36	3.049796	5.339478	32
QAD vs. ASRL	-9.009571	21.278501	132	-3.693744	6.178693	6	5.632958	8.654003	6

[a] For the Radian Channel Pair B-A, %Difference = (NMOC (A) - (NMOC (B))/((NMOC (A) + NMOC (B))/2)*100.

TABLE 4-29. STATISTICS FOR DUPLICATE ANALYSES

	Variables				
Statistics	NMOC[a]	DIFF[b]	ADIFF[c]	PDIFF[d]	APDIFF[e]
Cases	232	232	232	232	232
Minimum	0.073300	-1.670000	0.000000	-114.917130	0.000000
Maximum	4.401500	1.136000	1.670000	172.949640	172.949640
Mean	0.804828	-0.023947	0.105956	-2.921168	15.352906
Std. Dev.	0.663909	0.222059	0.196497	27.589135	23.086850
Std. Error	0.043494	0.014548	0.012873	1.807424	1.512470
Skewness	1.859036	-1.481555	4.673002	0.674198	3.251308
Kurtosis	4.517570	22.075888	27.119239	11.004010	13.584372

[a] NMOC = Average NMOC concentration of duplicate samples, ppmC.

[b] DIFF = Difference between NMOC concentrations for duplicate samples, ppmC.

[c] ADIFF = Absolute value of DIFF.

[d] PDIFF = DIFF/((ppmC for Duplicate No. 1 + ppmC for Duplicate No. 2)/2)x100.

[e] APDIFF = Absolute value of PCDIFF.

TABLE 4-30. DUPLICATE ANALYSES STATISTICS, BY SITE

Site Code	NMOC, ppmC		ADIFF[a], ppmC		APCDIFF[b], ppmC		Duplicate Pairs
	Mean	SD	Mean	SD	Mean	SD	
ATGA	0.9356	0.4614	0.1020	0.1075	16.4461	22.5961	9
B1MA	0.3125	0.0795	0.0221	0.0233	6.9001	7.3820	7
B2MA	0.7682	0.4123	0.0571	0.0857	11.9154	20.5264	9
BACA	1.6857	0.4536	0.1332	0.1379	7.9963	8.7163	13
BHAL	1.3619	1.3047	0.0537	0.0555	5.8681	6.1055	9
BMTX	0.5231	0.3221	0.0197	0.0151	6.5436	7.3136	7
BNY	0.9865	0.6123	0.1846	0.2284	15.8843	18.7380	7
BRLA	0.6897	0.2949	0.0291	0.0261	5.7121	8.5673	8
C1IL	1.4013	0.4427	0.1176	0.0738	9.9600	8.5651	6
C3IL	0.3873	0.3265	0.1136	0.2001	37.4104	57.6006	8
CIOH	0.7406	0.2360	0.0600	0.0660	8.8796	11.3689	6
DEGA	0.5665	0.3409	0.1077	0.1082	23.3864	30.4750	6
DLTX	0.4618	0.1973	0.0944	0.0448	21.4136	8.1526	4
ELCA	0.2821	0.1101	0.0446	0.0558	14.5613	17.6374	8
ELTX	0.4053	0.2428	0.0794	0.0604	42.0651	53.5894	7
FRCA	1.0423	0.0809	0.1418	0.0990	15.3882	13.6152	8
FWTX	1.0185	0.5954	0.2354	0.4424	15.9701	20.2724	6
H1TX	0.9762	0.8028	0.1124	0.1652	16.1645	27.4443	7
HTCT	0.6305	0.1789	0.0486	0.0655	16.3649	24.5172	6
LIKY	1.1190	0.6304	0.3280	0.5961	21.7495	28.5798	[illegible]
LICA	0.6090	0.2749	0.0738	0.0633	11.3118	7.2135	[illegible]
LVTX	0.7309	0.4496	0.0429	0.0288	9.5541	9.2103	6
MNY	0.7770	0.3190	0.0984	0.1372	11.3996	10.1675	7
NWNJ	0.7240	0.3141	0.1521	0.2386	15.5707	18.5290	7
P1OR	0.5217	0.3053	0.1244	0.1936	23.4854	42.1800	7
PICA	0.4121	0.2774	0.0406	0.0413	12.5199	16.1219	8
S1UT	1.2015	0.6989	0.0853	0.1585	10.2989	20.4536	6

(continued)

TABLE 4-30. DUPLICATE ANALYSES STATISTICS, BY SITE

Site Code	NMOC, ppmC		ADIFF[a], ppmC		APCDIFF[b], ppmC		Duplicate Pairs
	Mean	SD	Mean	SD	Mean	SD	
S2UT	0.8795	0.5841	0.1086	0.1650	11.9628	15.6004	9
SDCA	0.4632	0.3058	0.0481	0.0359	11.4846	8.5426	7
SFCA	0.2486	0.0506	0.0200	0.0188	7.4536	5.6610	7
SLMO	1.3590	1.4557	0.2380	0.3426	23.0045	28.4839	8
VICA	0.5248	0.2642	0.0943	0.0627	28.4128	26.1746	6
OVERALL	0.7964	0.6527	0.1008	0.1802	15.2149	23.0402	232

[a] ADIFF is the mean of the absolute value of the difference between duplicates, ppmC.

[b] APCDIFF is the mean of the absolute percent differences which equals ADIFF/((NMOC Duplicate No. 1 + NMOC Duplicate No. 2)/2) x 100.

code. The mean absolute percentage differences between duplicates ranged from 5.71% for BRLA to 37.4% for C3IL.

These results are higher than in 1986, but still represent good precision. The analytical error for repeated analyses was 9.61% while the precision for duplicates was 15.2%. The difference represents the duplicate sampling error.

4.2.5 Canister Cleanup Results

Prior to the start of the 1987 NMOC Sampling and Analysis Program all of the canisters were cleaned and analyzed for their NMOC content to establish canister initial conditions. The resulting analysis with cleaned, dried air that had been humidified averaged 12.7 area counts (0.0042 ppmC), ranging from zero to 34.15 area counts (0.011 ppmC). Any canisters that produced greater than 0.030 ppmC were recleaned.

Continual monitoring of the cleanup was important to ensure that there was negligible carry-over from one site sample to the next. The daily canister cleanup procedure is described in detail in Section 3.4. The NMOC content was below 0.030 ppmC and cleanup was considered to be satisfactory.

Percent recoveries or percent cleanup, in 1987 averaged 99.374% (99.891% in 1986 and 99.898% in 1985), ranging from 92.10% to 100%. The reported percent cleanup figures should be considered to be minimum values. The actual cleanup was greater than the reported values because, after the percent cleanup was measured, the canister was evacuated a fourth time before being shipped to the sites.

4.2.6 External Audit Results

Primary measures of accuracy were calculated from the results of the analysis of audit samples provided by EPA-QAD. Results are reported in terms of percent bias, relative to the EPA standards.

Audit samples of propane provided by EPA-QAD were referenced to NBS SRM propane No. 1667b. Each Radian cannel and the EPA-ASRL channel analyzed each audit sample. The results of these analyses are given in Table 4-31. Audit sample bias, percent bias, and absolute percent bias are shown in Table 4-32. In Table 4-32, all bias measurements are all relative to the QAD results. Overall Radian average bias was -1.31% indicating Radian channels averaged 1.31 percent lower than the EPA-QAD reference values. Radian mean bias ranged from -0.06 percent for Channel A to -2.8 percent for Channel B. The overall

TABLE 4-31. 1987 NMOC AUDIT SAMPLE RESULTS

Date Analyzed	Julian Date Analyzed	Radian ID Number	Chan. A NMOC (ppmC)	Chan. B NMOC (ppmC)	Chan. C NMOC (ppmC)	Chan. D NMOC (ppmC)	ASRL NMOC (ppmC)
08/18/87	230	2708	1.072	1.058	1.082	1.052	-
08/18/87	230	2709	4.234	3.996	4.184	4.065	-
09/04/87	247	3138	1.908	1.840	1.893	1.893	-
09/04/87	247	3139	3.945	3.780	3.882	3.814	-
10/01/87	274	3750	3.023	2.970	2.988	3.062	3.229
10/01/87	274	3749	1.928	1.914	1.924	1.917	2.060

TABLE 4-32. AUDIT SAMPLES, RELATIVE TO EPA-QUALITY ASSURANCE DIVISION (QAD) RESULTS

	DELTAA (ppmC)	DELTAB (ppmC)	DELTAC (ppmC)	DELTAD (ppmC)	DELTAE (ppmC)	Chan. A Percent Bias	Chan. B Percent Bias	Chan. C Percent Bias	Chan. D Percent Bias	Chan. E Percent Bias	Radian Percent Bias
	0.00200	-0.01200	0.01200	-0.01800	-	0.18692	-1.12150	1.12150	-1.68224	-	
	-0.20600	-0.44400	-0.25600	-0.37500	-	-4.63964	-10.00000	-5.76577	-8.44595	-	
	-0.01200	-0.08000	-0.02700	-0.02700	-	-0.62500	-4.16667	-1.40625	-1.40625	-	
	0.00600	-0.15900	-0.05700	-0.12500	-	0.15232	-4.03656	-1.44707	-3.17339	-	
	0.06100	0.00800	0.02600	0.10000	0.26700	2.05942	0.27009	0.87779	3.37610	9.01418	
	0.04700	0.03300	0.04300	0.03600	0.17870	2.49867	1.75439	2.28602	1.91388	9.50027	
Average	-0.01700	-0.10900	-0.04317	-0.06817	0.22285	-0.06122	-2.88337	-0.72230	-1.56964	9.25722	-1.30913
Std. Dev.	0.09676	0.17823	0.11046	0.16776	0.06244	2.54706	4.19953	2.87887	4.15909	0.34371	3.52525

Absolute Values of Percent Bias

						Radian Absolute Percent Bias
	0.18692	1.12150	1.12150	1.68224	-	
	4.63964	10.00000	5.76577	8.44595	-	
	0.62500	4.16667	1.40625	1.40625	-	
	0.15232	4.03656	1.44707	3.17339	-	
	2.05942	0.27009	0.87779	3.37610	9.01418	
	2.49867	1.75439	2.28602	1.91388	9.50027	
Average	1.69366	3.55820	2.15073	3.33297	9.25722	2.68389
Std. Dev.	1.74635	3.52417	1.83390	2.63138	0.34371	2.53756

For Channel A:
ppmC DELTAA = NMOCA - QAD
Percent Bias = (ppmC DELTAA)/QAD*100

Channel E is EPA-ASRL Channel

average absolute percent bias for the Radian channels was 2.68 percent. These accuracy measurements show excellent agreement with the reference values, and lend confidence to the 1987 NMOC concentration results determined on all the Radian channels.

The EPA-ASRL channel averaged +9.3% bias, relative to EPA-QAD.

Figures 4-28, 4-29, 4-30, and 4-31 show the audit bias results for the Radian channels versus the reference values provided by EPA-QAD. A linear relation exists over the range of concentrations of the audit samples. The orthogonal regression lines shown on the figures indicate a negative slope. The audit bias results comparing the EPA-ASRL versus EPA-QAD are shown in Figure 4-32. For this comparison the orthogonal linear relation shows a positive slope. The slopes for the Radian channels are not significantly different form zero, while the slope of the ASRL-QAD comparison is significantly greater than zero.

4.2.7 Data Validation

The secondary backup disks were updated daily on 20 megabyte hard disks. At the completion of the sampling and analysis phase 10.1 percent of the data base was checked to verify its validity. Items checked included original data sheets, checks of all the calculations and data transfers. In making the calculations for the final report and other reports, corrections were made to the data base as errors or omissions were encountered.

A total of 3,207 NMOC measurements by Radian are in the 1987 NMOC data base. This includes 2746 site samples and 157 repeated analyses of site samples by Radian channels. In addition, 53 QC samples, 17 local ambient samples, and 6 external audit samples were each analyzed by all four Radian channels. Each of these samples had a unique sample I.D. number, with the exception of the 157 repeated analyses. Each NMOC datum has 54 individual items associated with that datum.

Ten percent of the data base (324 cases out of 3,207 data points) was selected at random and validated according to the procedure outlined below.

A. Calibration factors were checked.

   1. The area count from the strip chart that was used to determine the calibration factor was examined to verify that the data had been properly transferred to the calibration form.

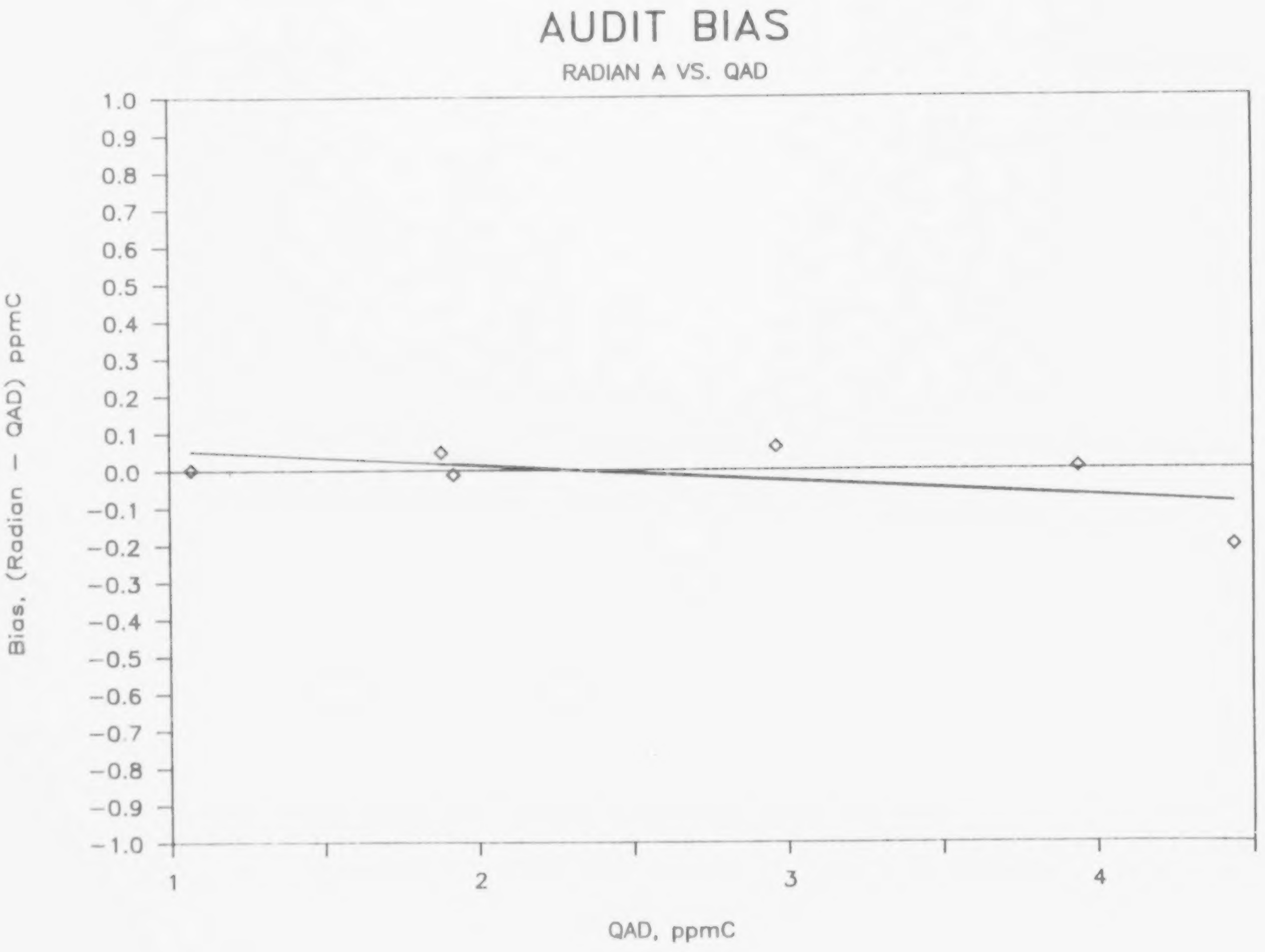

Figure 4-28. Audit bias, Radian Channel A vs. EPA-QAD.

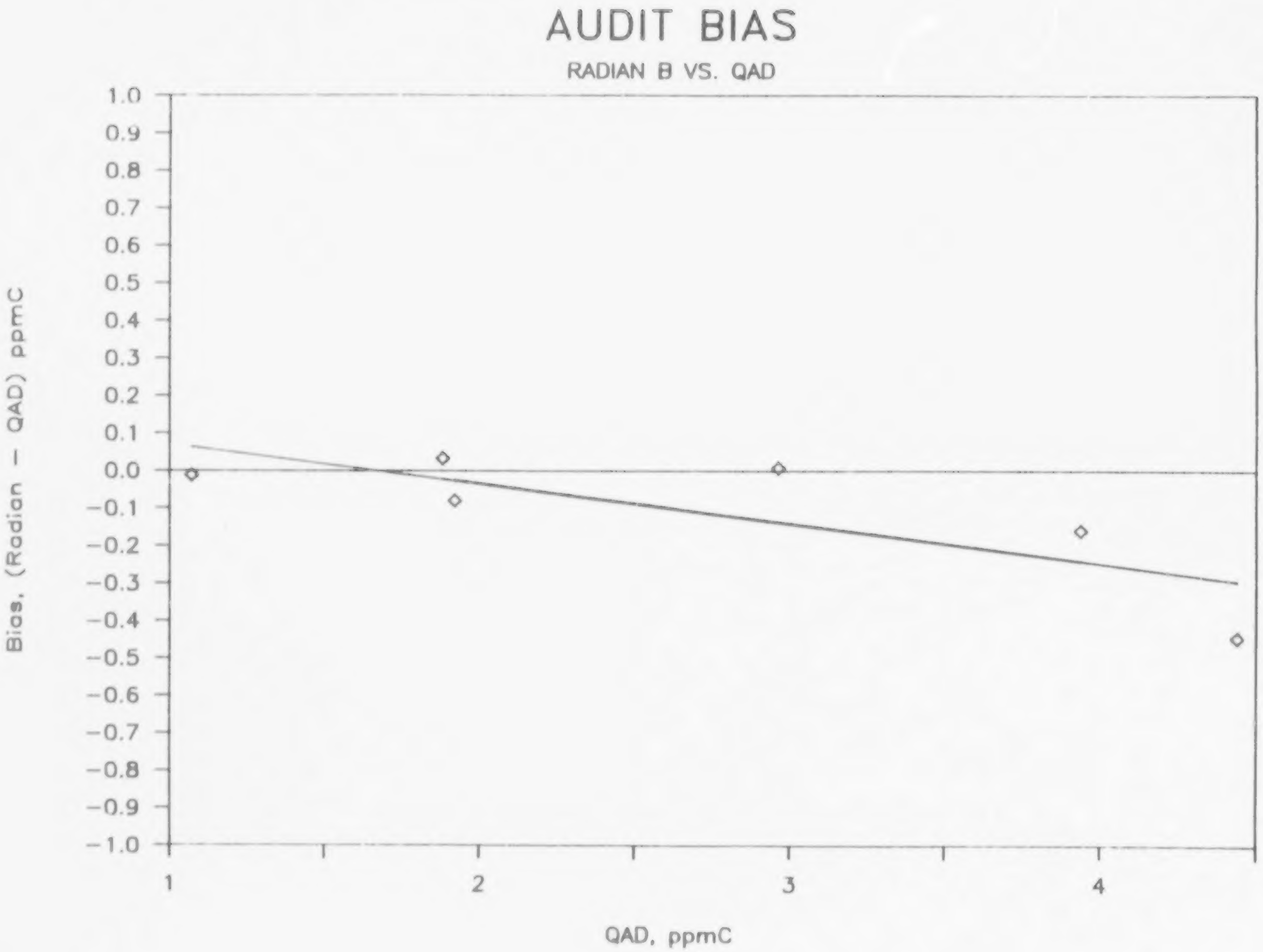

Figure 4-29. Audit bias, Radian Channel B vs. EPA-QAD.

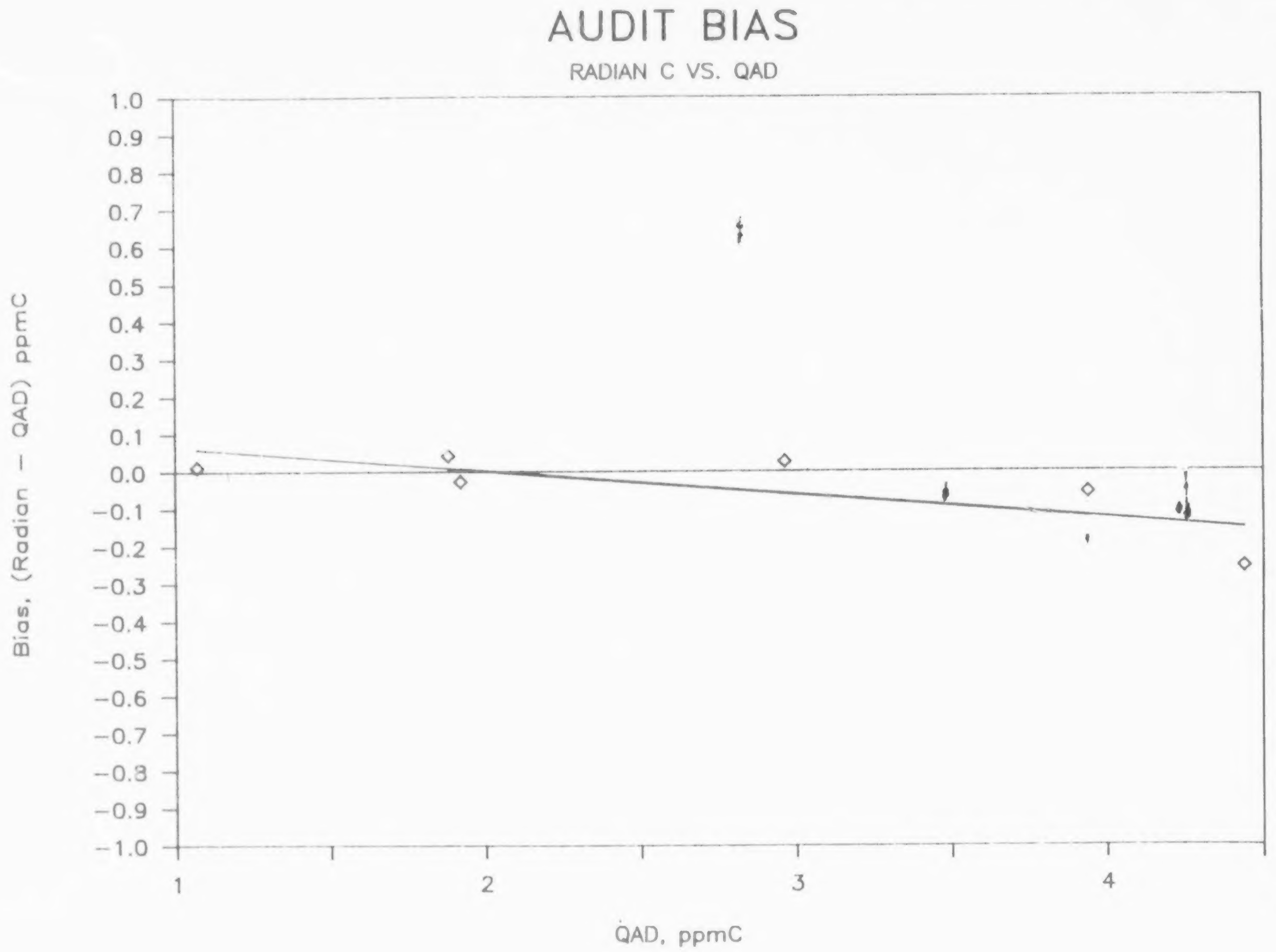

Figure 4-30. Audit bias, Radian Channel C vs. EPA-QAD.

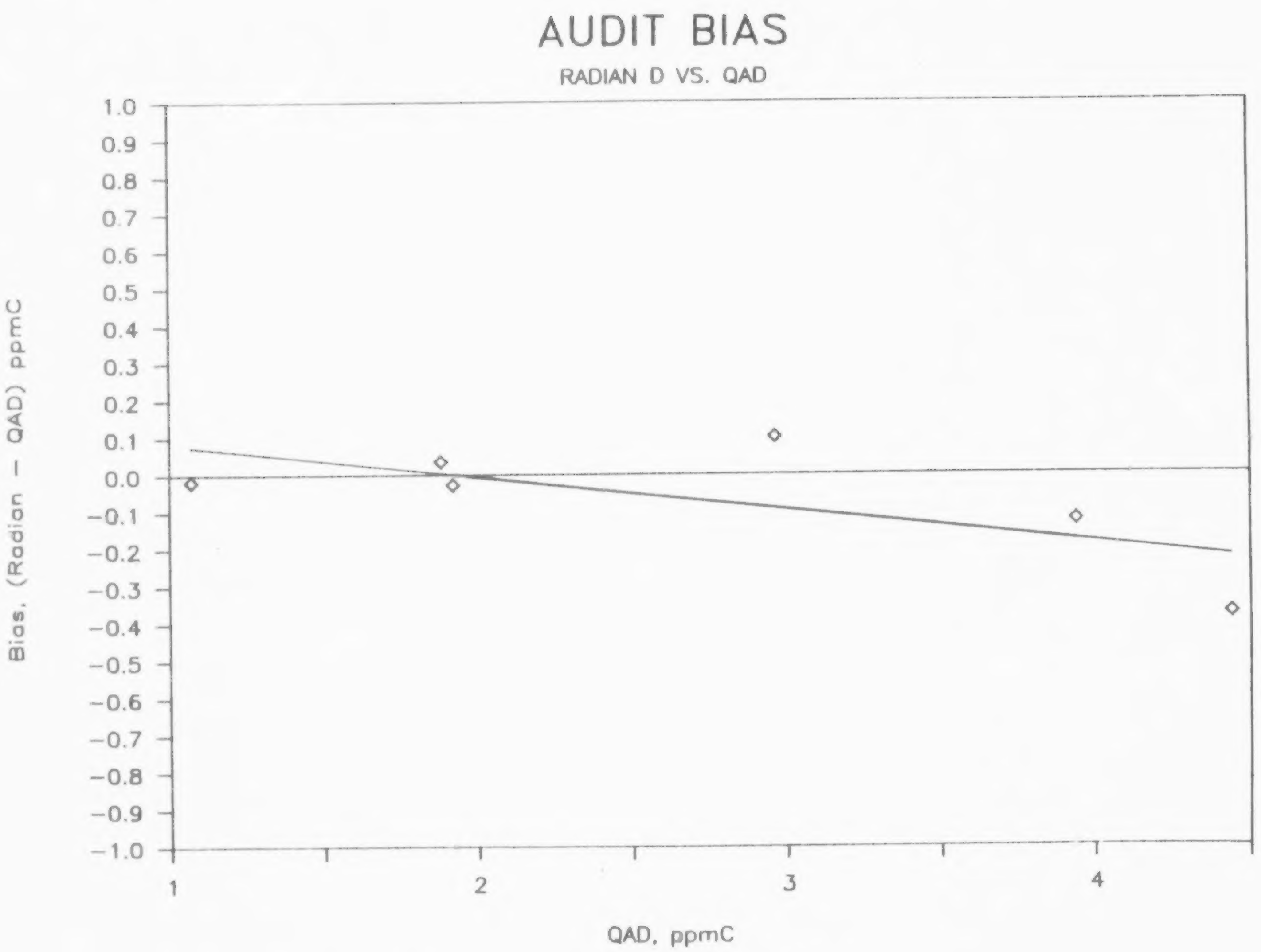

Figure 4-31. Audit bias, Radian Channel D vs. EPA-QAD.

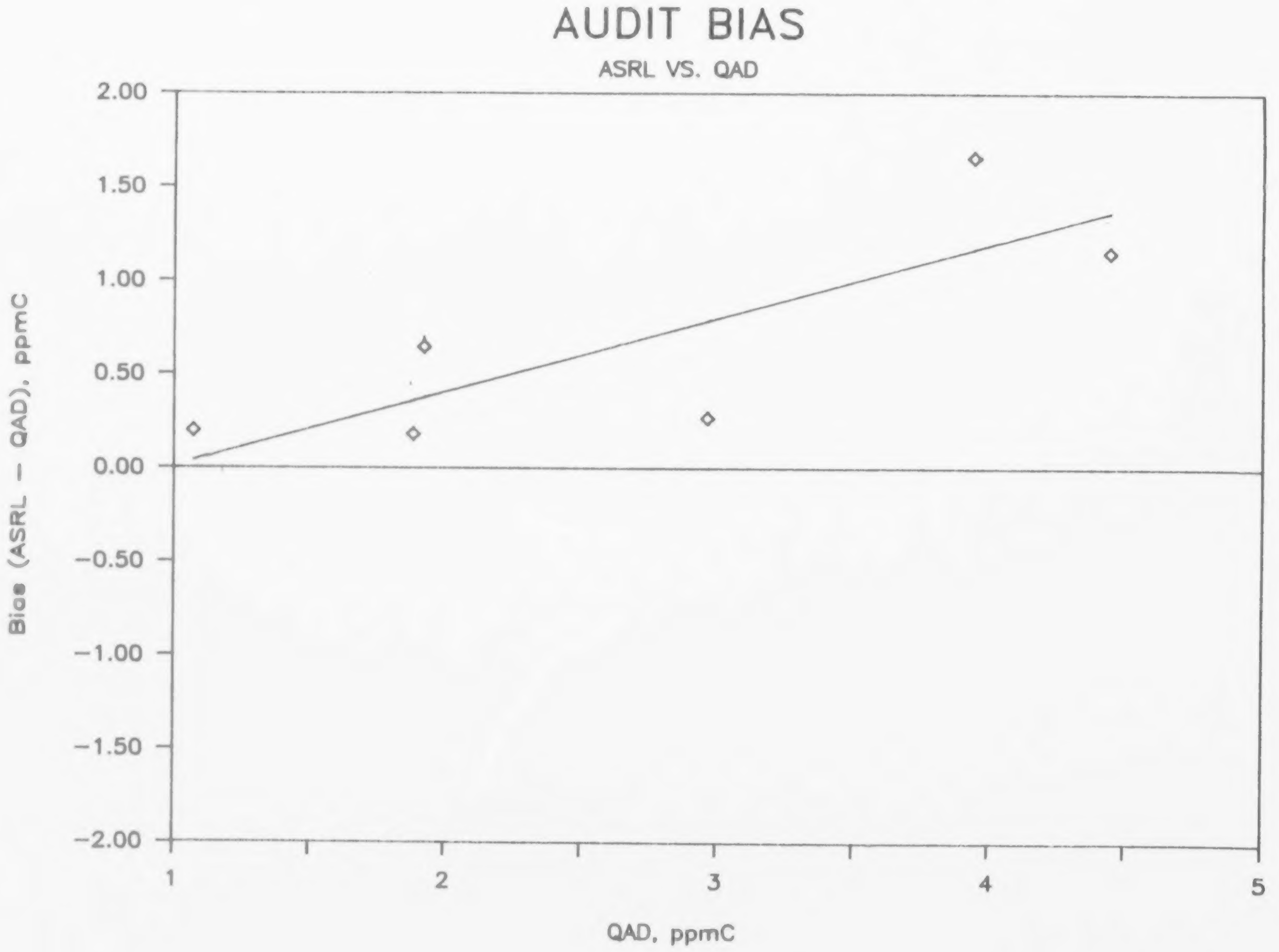

Figure 4-32. Audit bias, EPA-ASRL vs. EPA-QAD.

2. The calibration form was examined to verify that the calculations had been correctly made.

3. Each datum on the disk was compared to the corresponding datum on the calibration sheet for accuracy.

B. Analysis data were checked.

1. Area counts were verified from the appropriate strip chart.

2. Calculations were reverified on the analysis forms.

3. Each datum on the disk was compared to the corresponding item on the analysis form.

C. Field sheet data were checked.

1. Each datum on the disk was compared to the corresponding datum on the field data sheet.

The error rate calculated in terms of the number of items transferred from the original data sources. For each NMOC value in the 1987 data set, 54 items were transferred from original sources to the magnetic disks. In the Data Validation study each item or the disk was compared with the corresponding value on the original source of data. Three errors were found (and corrected) for an expected error percentage of 0.017.

Each time the data file was opened and a suspected error found, it was checked against the original archived documents, and corrected where appropriate.

4.3. QUALITY ASSURANCE RECORDS

The quality assurance records developed by Radian for this project are extensive and will be preserved as archives. One of the most important objectives of the study was to develop a data base that was well planned and documented, and contained NMOC data of known and verifiable quality. Achieving that objective has involved keeping and preserving a number of records that trace the project from planning through reporting.

4.3.1 Archives

In order to keep detailed records which document the quality of the measurements made, Radian developed the following original material:

- Quality Assurance Project Plan;
- Notebooks;
- Field Data Sheets;
- Laboratory Calibration Sheets;
- Laboratory Analysis Sheets;
- Chromatographic Strip Charts;
- EPA-ASRL & EPA-QAD NMOC Results;
- Bi-weekly, Monthly Reports to EPA;
- Memoranda and Correspondence; and
- Final Report.

In addition to the above items, several papers to be presented at technical meetings and symposia and published in technical journals will be added to the archives.

The QAPP was the Quality Assurance Project Plan and the workplan. It was designed according to the EPA Quality Assurance Guidelines, and set the pattern of steps necessary to document and control the quality of the data obtained throughout the study.

Several notebooks were necessary to maintain day-to-day records of the project. Field and laboratory data sheets were designed in advance, so that the data recorded appeared in a logical sequence and filled in blanks on the sheet. Additional space was provided for other comments. Each NMOC analysis was assigned a unique Radian Identification Number. Field data sheets and shipping records accompanied the canisters in transit.

4.3.2 Magnetic Disks

In order to manage the data base for report generation and data analysis, pertinent data from the various data sheets and notebooks were transferred to 20 megabyte magnetic disks. Lotus 1-2-3^R and PFS^R software were used in the construction of the data base. Statistical calculations were done using SYSTAT^R software. The data access is rapid and in a convenient form. The primary 20 megabyte magnetic disk has three backup disks.

5.0 NMOC DATA ANALYSIS AND CHARACTERIZATION

The summary NMOC data for the 32 sites of the 1987 study are given in Tables 2-5 through 2-27. The purpose of this section is to characterize the NMOC data qualitatively as well as quantitatively. The NMOC data are shown to fit a two-parameter lognormal distribution better than a normal Gaussian distribution.

Figure 5-1 gives a stem-and-leaf plot of the 1987 NMOC data along with statistics for NMOC, injection standard deviation, and logarithms of the NMOC values. The "injection standard deviation" is the standard deviation of the two or three NMOC injections performed for each determination of a measured NMOC value. The stem-and-leaf plots show the actual NMOC concentrations truncated to two decimal points. The digits to the left of the vertical open space are called stems and the digits to the right of the open space are the leaves. The data are sorted from the smallest at the top of the graph to the largest at the bottom of the graph. The minimum NMOC value measured was 0.045 ppmC and is shown as "0   4" on the first row at the top of the plot. The maximum NMOC concentration measured was 10.767, shown as "107   6" at the bottom row of the chart. The plot shows 2,746 leaves, one for each NMOC site datum in the 1987 Program. The H's in the open vertical space locate the stem and leaf for the upper and lower hinges, and the M locates the stem and leaf for the median. The median separates the sorted data into two equal halves, the hinges (or quartiles) separate each half into two equal halves. The "H spread" or inter-quartile range is the difference between the NMOC values of the two hinges.

Statistics shown for NMOC and injection standard deviation are number of cases, minimum, maximum, mean, standard deviation, standard error, skewness, and kurtosis. Each NMOC determination is the average of two or three injections of the site sample. Injection standard deviation is the standard deviation of the injections for each NMOC measurement.

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```
 0     455
 0     67777 777
 0     89999 999
 1     00000 11111 111
 1     22222 22222 22223 33333 33333 33333 3
 1     44444 44444 44445 55555 55555 55555 55555 5555
 1     66666 66666 66666 66666 66667 77777 77777 77777 77777 77777 7
 1     88888 88888 88888 88888 88888 89999 99999 99999 99999 99999 99
 2     00000 00000 00000 00000 00000 00000 00111 11111 11111 11111 11111 11111 11111 11111 11
 2     22222 22222 22222 22222 22223 33333 33333 33333 33333 33333 333
 2     44444 44444 44444 44444 44444 44444 44444 44444 44555 55555 55555 55555 55555 55555 55555 55555 55555
 2     66666 66666 66666 66666 66666 66666 66666 66666 67777 77777 77777 77777 77777 77777 77777 77777 77
 2     88888 88888 88888 88888 88888 88888 88888 88889 99999 99999 99999 99999 99
 3     00000 00000 00000 00000 00000 00000 11111 11111 11111 11111 11111 11111 11111 1111
 3 H   22222 22222 22222 22222 22222 22222 22222 22222 22333 33333 33333 33333 33333 33333 33333 33333 33
 3     44444 44444 44444 44444 44444 44444 44444 45555 55555 55555 55555 55555 55555 55
 3     66666 66666 66666 66666 66666 66666 66666 66666 66666 77777 77777 77777 77777 77777 77777 77777 77
 3     88888 88888 88888 88888 88888 88889 99999 99999 99999 99999 99999 99999 99999 9999
 4     00000 00000 00000 00000 00000 00000 11111 11111 11111 11111 11111 11111 111
 4     22222 22222 22222 22222 22222 22223 33333 33333 33333 33333 33333 33333 3333
 4     44444 44444 44444 44444 44444 44445 55555 55555 55555 55
 4     66666 66666 66666 66666 66666 67777 77777 77777 77777 77777 777
 4     88888 88888 88888 88888 88888 88888 88899 99999 99999 99999 99999 9
 5     00000 00000 00000 00000 11111 11111 11111 11111 11111 1
 5     22222 22222 22222 22222 22222 22333 33333 33333 33333 33
 5     44444 44444 44444 44444 44444 55555 55555 55555 55555 555
 5 M   66666 66666 66666 66666 66666 66666 66677 77777 77777 77777 77777 7
 5     88888 88888 88888 88888 88888 99999 99999 99999 99999 99999 99
 6     00000 00000 00000 00000 00111 11111 11111 11111 11111 11
 6     22222 22222 22222 22222 22333 33333 33333 33333 333
 6     44444 44444 44444 44444 44455 55555 55555 55555 55555 55555 55555 5
 6     66666 66666 66666 66666 66666 66666 66777 77777 77777 77777 777
 6     88888 88888 88888 88889 99999 99999 99999 99
 7     00000 00000 00000 00001 11111 11111 11111 11111
 7     22222 22222 22222 22233 33333 33333 33333 33333 33
 7     44444 44444 44444 44455 55555 55555 55555
 7     66666 66666 66667 77777 77777 77777 77
 7     88888 88888 88888 89999 99999 99999 99
 8     00000 00000 00111 11111 111
 8     22222 22222 22222 22333 33333 33333 3333
 8     44444 44444 44444 44444 45555 55555
 8     66666 66666 66666 77777 77777 777
 8     88888 88889 99999 99999 99999 999
 9 H   00000 00000 00000 00111 11111 11111 111
 9     22222 22222 22233 33333 33333 3333
 9     44444 44444 44555 55555 5
 9     66666 66667 77777 77777 77777 777
 9     88888 88888 99999 99999 999
10     00000 00000 00001 11111 11111
10     22222 22223 3333
10     44444 44444 45555 55
10     66666 66677 777
10     88889 99999 99999 999
11     00000 00000 00000 11111 111
11     22222 22222 22333 33333 33333
11     44444 44555 55555
11     66666 67777 77777 7
11     88888 88889 99999 99
12     00000 01111 11
12     22223 3333
12     44444 44555 55555 55
12     66677 77777
12     88888 88888 99999 99
13     00000 00001 11111 11
13     22233 3333
13     44445 555
13     66667 77777 7777
13     999
14     00000 11111
14     22223 33333 33
14     45555 555
14     66677 7
14     88888 89999 99
15     00001 1111
15     22222 23333
15     4455
15     66677 777
15     89999
16     00011 111
16     22222 22233 33
16     4455
16     66667
16     8899
17     01
17     22
17     44445 55
17     66666 67
17     88899
18     00012 22245 55777 8899
19     01122 35677 9
20     00003 35556 66788 89
21     00012 23566 77789 9
22     11233 45788 89
23     02334 5567
24     23468
25     33345 7
26     24567 7
27     333
28     2379
29     69
30     02235 68
31     235
32     179
33     01
34     3467
35     4
36     6
43     2
44     2467
52     4
53     0
82     6
89     1
93     5
94     2
99     6
107    4
```

	NMOC, ppmC	Injection Standard Deviation
Cases	2746	2746
Minimum	0.045	0.658
Maximum	10.767	0.000
Mean	0.738	0.018
Standard Deviation	0.634	0.030
Standard Error	0.014	0.001
Skewness	5.476	7.063
Kurtosis	54.383	98.928
Lower Hinge (H)	0.333	
Median (M)	0.559	
Upper Hinge (H)	0.920	

Figure 5-1. Stem-and-leaf plot of the 1987 NMOC data.

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The standard error is the standard deviation divided by the square root of the number of cases. Positive skewness is a third moment about the mean value, and characterizes a tail to the right of the mean value. A normal Gaussian distribution has a skewness of zero. The skewness of 5.5 for the 1987 NMOC data suggests a lognormal frequency distribution; that is supported by the fact that for ln(NMOC) (see Figure 5-2), skewness equals 0.128, which is close to zero. Kurtosis is the fourth moment about the mean and relates to the pointedness of the distribution. A distribution more pointed than a normal distribution, having the same standard deviation, has a kurtosis greater than 3.0.

In Figure 5-1 there is a small node in the region of NMOC concentration from 1.8 to 2.5 ppmC. This occurrence was not seen in previous years of the NMOC Monitoring Program (1984, 1985, or 1986). Detailed investigation of the data in this region showed them to be primarily from BACA, LICA, S1UT, and SLMO. There were a number of recorded values of NMOC between 2.0 and 9.9 ppmC, especially at FRCA, during the time that forest fires were widespread in California, but these NMOC concentrations did not contribute significantly to the node cited above.

Figure 5-2 is a stem-and-leaf plot of the 1987 ln(NMOC) data. The plot shows an approximately symmetrical distribution (skewness = 0.128). The kurtosis equal to 0.175 indicates the ln(NMOC) distribution to be less pointed than a normal distribution. The node seen on Figure 5-1 is not apparent in Figure 5-2.

The shape of the stem-and-leaf plots suggests a lognormal distribution. Figures 5-3 and 5-2 support the lognormal distribution hypothesis for NMOC. The vertical scales in Figures 5-2 and 5-3 are arranged so that if the cumulative frequency of occurrence of NMOC is normally distributed, the numbers would plot into a straight line. The line in Figure 5-3 has a noticeable concave downward trend, indicating that the data do not fit a normal distribution well. Figure 5-4 plots the logarithm of NMOC on the same vertical scale. The fact that the digits on the graph plot into approximately a straight line supports the hypothesis that the NMOC data are approximately lognormally distributed. The asterisks on the graph indicate the location of a single datum. Integers, such as 2, 6, or 9, show the location of the corresponding number of data points. The number 999 shows the approximate location of either 27 data points or 99 + 9 data points. The results,

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```
31    0
30
29    3
28    61
26    1
25    99765 5
25    1
24
24
23    97765 5
23    4
22    755
22    320
21    975
21    43331 11
20    99877 6655
20    44443 22000
19    99888 88776 65555
19    33332 220
18    99999 99887 77776 66655 5
18    33333 33222 10000 0000
17    98888 77777 77655 555
16    99999 88888 77766 66655 555
16    44433 33332 22222 11110 00000 00
15    99998 88887 77777 77777 66666 66666 66555 55555 555
15    44444 33333 32222 22211 11100 00000 00
14    99998 88888 77766 66666 66655 55
14    44444 44444 33333 22222 22211 11111 11111 11000 00000
13    99999 99999 99888 88888 88887 77777 77777 66666 66655 55555 55555 5
13    44444 43333 33333 22222 22222 22221 11111 11111 10000 00000 0
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10 H  99999 99999 99998 88888 88887 77777 77777 77777 76666 66665 55555 55556
10    44444 44444 44444 44333 33333 33333 32222 22211 11111 11111 11111 11100 00000 00000 0000
9     99999 99999 99998 88888 88887 77777 77777 77777 77776 66666 66666 65555 5555
9     44444 44444 44444 44333 33333 33333 33322 22222 22222 21111 11111 11000 00000 0000
8     99999 99999 99988 88888 88888 77777 77777 77777 66666 66666 66666 66655 55555 5
-8    44444 44444 44444 44333 33333 33333 33322 22222 22211 11111 11111 00000 00000 00000
7     99999 99998 88888 87777 77777 77777 76666 66666 65555 55555 555
7     44444 44444 44443 33332 22222 22222 22222 22221 11111 11111 11110 00000 00000 00000
-6    99999 99999 99888 88777 77777 77666 66666 66665 55555 55555 55555 555
-6    44444 44444 44443 33333 33333 32222 22222 21111 11111 11100 00000 00000 00
-5 M  99999 99999 99888 88888 88888 77777 77777 77777 77777 66666 66666 66666 66655 55555 555
-5    44444 44444 44444 43333 33333 33333 22222 22222 22111 11111 11111 11111 11000 00000 00000
-4    99999 99999 99999 98888 88888 88888 88777 77777 77766 66666 66666 55555 55555 55555 555
-4    44444 44444 43333 33333 33333 33222 22222 22222 22222 22222 22211 11111 11111 11111 10000 00000 00000 00000
-3    99999 99999 99888 88888 88888 88777 77777 77777 78888 88888 55555 55555 55555 56
-3    44444 44444 44443 33333 33333 33333 32222 22222 22221 11111 11111 11111 10000 00000 00000 00
-2    99999 99999 99999 88888 88888 77777 77777 77777 66666 65555 55555 5555
-2    44444 44444 44444 44333 33333 33322 22222 22222 22111 11111 11000 00000
1     99999 99999 99888 88888 88887 77777 77777 77666 66666 66666 66655 55555 5
-1    44444 44444 44433 33333 33333 32222 22111 11111 11111 11000 00000 00000 00000
-0 H  99999 99999 99998 88888 88888 87777 77777 77766 66666 66666 66555 55555 55555
-0    44444 44433 33333 32222 22222 22222 22222 11111 11111 10000 00000 000
0     00000 00000 00000 01111 11111 12222 22222 33333 34444 44444 4
0     55555 56666 66666 67778 88888 88899 99999 99999 9999
1     00000 00000 11111 11111 11111 12222 22222 22222 33333 33333 44444
1     55555 55555 66666 66666 67777 77777 77888 88889 99999 9
2     00000 01111 11122 22222 22233 33333 44444 44444 44
2     55555 55556 66666 66667 77777 77788 88888 99999
3     00001 11111 11111 22233 33333 44444 4
3     55556 55666 66677 77777 88888 99999 999
4     00000 00011 11111 12222 22223 34444 4
4     55555 66666 77777 77888 88888 88899 99
5     00000 11122 23344
5     55556 66666 66677 78888 889
6     00001 11222 33333 444
6     55557 78889 999
7     01112 22223 33344 4
7     55567 77778 88999
8     00012 22223 444
8     55566 899
9     01223 334
9     67788 8
10    00034
10    5689
11    00001 11344
11    68999
12    3344
12    69
14    68999
16    56
20
21    18
22    34
23    07
```

	ln(NMOC)
Cases	2746
Minimum	-3.101
Maximum	2.376
Mean	-0.583
Standard Deviation	0.601
Standard Error	0.014
Skewness	0.128
Kurtosis	0.175
Lower Hinge (H)	-1.100
Median (M)	-0.576
Upper Hinge (H)	-0.084

Figure 5-2. Stem-and-leaf plot for the 1987 ln(NMOC) data.

1870780R

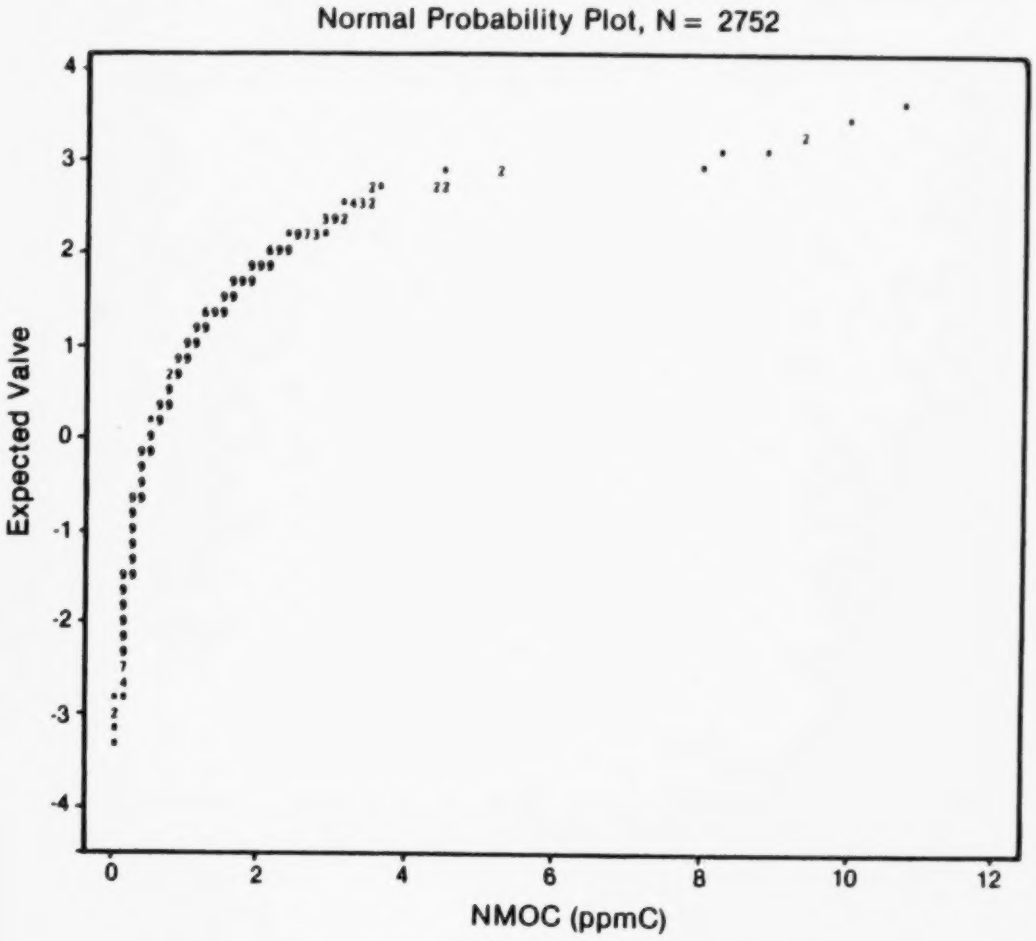

Figure 5-3. Cumulative frequency distribution for 1987 NMOC data.

1870781R

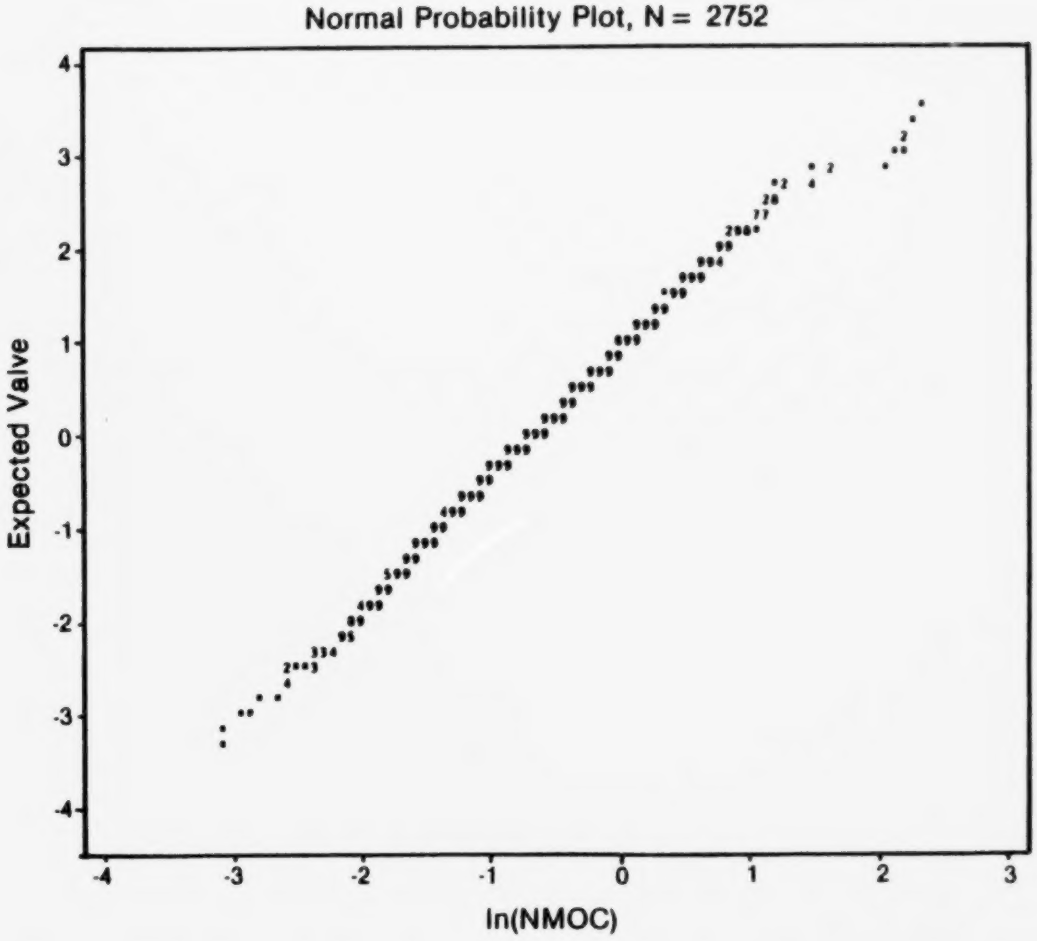

Figure 5-4. Cumulative frequency distribution for ln(NMOC) data.

1870782R

although qualitative, show a dramatic difference between the normal and lognormal hypotheses, and suggest that the latter more nearly describes the NMOC data. Figure 5-4 is labeled a "Normal Probability Plot," but since the independent variable is the logarithm (to the base e) of NMOC, if the relation between the EXPECTED VALUE and ln(NMOC) is linear, a lognormal distribution obtains.

Table 5-1 partitions the NMOC data for the summer of 1987 into groups which correspond to monthly intervals. The time interval for June corresponds to Julian Dates 151 to 181; for July to 182 to 212; for August to 213 to 243; for September to 244 to 273; for October to 274 to 304.

The data for September are higher than for June, July, or August, but no clear trend is seen for the summer of 1987. Some of the September data fall in the node discussed above in reference to Figure 5-1, but the majority of the data in the node did not include data in September. The high NMOC mean concentration in October is not representative of an overall average concentration because only two California sites supplied samples (BACA and PICA).

Figures 5-5 through 5-9 give the stem-and-leaf plots of the NMOC data for June, July, August, September, and October 1987, respectively. All the plots show the general shape of lognormal distribution with the exception of Figure 5-9 for October. The October 1987 data are for only two California sites, BACA and PICA, and should not be considered comparable to the other monthly graphs. The data for June, July, August, and September may be considered typical of the 32 sites tested during the indicated time period. Monthly mean NMOC emissions are plotted in Figure 5-10 for 1984, 1985, 1986, and 1987. No general trends are evident for the years shown. For three of the four years, September means are higher than August means, and for three of the four years July means are less than June means. At present, however, it must be concluded that random behavior is responsible for apparent month-to-month changes.

TABLE 5-1. SUMMARY STATISTICS FOR NMOC, BY MONTH

Sample Month, 1987	Minimum NMOC (ppmC)	Median NMOC (ppmC)	Mean NMOC (ppmC)	Maximum NMOC (ppmC)	Standard Deviation NMOC (ppmC)	Cases
June	0.057	0.538	0.670	4.448	0.544	625
July	0.045	0.520	0.708	9.420	0.682	702
August	0.078	0.531	0.699	9.984	0.773	666
September	0.047	0.625	0.833	10.767	0.818	667
October[a]	0.319	1.284	1.308	2.733	0.611	56

[a] Only two sites participated in October NMOC monitoring, BACA, PICA. The data from BACA averaged 0.424 ppmC for the entire sampling period (June through October), which was significantly higher than other sites. The average NMOC concentration for PICA was 0.629 ppmC.

```
 0    57779
 1    01122 23333 444
 1    55555 55556 66666 67777 77777 88888 8899
 2    00000 00000 01111 11111 11222 33333 44444 44444
 2    55555 55555 66666 66666 67777 77777 77778 88888 88999 9
 3 H  00000 00011 11111 22222 22223 33333 33344 44444 444
 3    55555 55566 66667 77777 77888 88889 99999 99999 9
 4    00000 00000 01111 11222 22223 33333 34444 4
 4    55555 55666 66666 66777 77778 88888 99999
 5 M  00001 11112 22222 22222 33344 4444
 5    55555 56666 67777 78888 99999 9
 6    00000 00111 11111 22222 22233 33333 44444
 6    55555 55555 66666 66777 78888 88999 99999
 7    00000 01111 11222 22333 33334 44444 4
 7    55555 66677 78888 9999
 8 H  01222 22334 4444
 8    55556 66777 89999 9999
 9    00223 3344
 9    55679 9999
10    00122 44
10    56899 999
11    00000 12223 33344
11    56778 89
12    12334
12    57888 9
13    00012 2334
13    56777 9
14    00123
14    5789
15    00113 4
15    79
16    13367
17    45
18    17
19    7
21    02
22    3
23    026
27    3
28    9
29    6
30    02
32    9
34    4
35    4
36    6
44    4
```

	NMOC, ppmC
Cases	625
Minimum	0.057
Maximum	4.448
Mean	0.670
Standard Deviation	0.544
Standard Error	0.022
Skewness	2.678
Kurtosis	10.428
Lower Hinge (H)	0.324
Median (M)	0.538
Upper Hinge (H)	0.822

1870809R

Figure 5-5. Stem-and-leaf plot of the NMOC data for June, 1987.

```
 0     4
 0     7778
 1     01222 22223 33333 33444 4444
 1     55556 66666 77777 77777 88888 89999 99999 99
 2     00000 00001 11111 12222 22223 33333 44444 4444
 2     55555 55555 55556 66666 66666 66677 77777 78888 88888 88888 899
 3 H   00000 00111 11111 22222 22222 33333 33333 33444 44444 444
 3     55555 55556 66666 66666 66667 77777 77788 88888 89999 99999 99999 9
 4     00000 01111 11111 11112 22233 33333 33333 44444 44444 444
 4     55566 66677 77777 77888 88999 999
 5 M   00000 11111 11222 22233 33444 44444
 5     55556 66666 66677 77788 88889 99999
 6     00000 11111 11222 23333 334
 6     55555 55556 66666 67777 77889 999
 7     01112 22333 33334 4
 7     55555 56677 77778 99999 99
 8     00000 01111 11223 33444 444
 8     55566 67888 99999
 9 H   00000 11122 22334 44444
 9     55677 77777 88899
10     00000 11112 22234 44
10     56777 9
11     00001 12223 33344 4
11     55677 88
12     00112 2244
12     55577 7789
13     0124
13     5677
14     01133 33
14     5668
15     01233 4
15     55667 79
16     00113 4
16     6889
17
17     56
17     89
18     02258 99
19     15
20     0689
21     06
22     188
23     4
24     6
25     3
26     56
31     2
32     7
34     36
43     2
44     7
52     4
53     0
94     2
```

	NMOC, ppmC
Cases	702
Minimum	0.045
Maximum	9.420
Mean	0.708
Standard Deviation	0.682
Standard Error	0.026
Skewness	4.956
Kurtosis	45.374
Lower Hinge (H)	0.323
Median (M)	0.520
Upper Hinge (H)	0.902

1870807R

Figure 5-6. Stem-and-leaf plot of the NMOC data for July, 1987.

```
 0     7999
 1     00011 23334 44
 1     55555 66666 66677 77788 88888 88999 99999 9
 2     00000 00001 11111 11111 11112 22233 33333 33333 33444 44444 44
 2     55555 55555 55566 66666 67777 77777 77888 88888 99999 99999 99
 3 H   00000 00000 01111 11111 11111 12222 22222 22222 33333 33334 44444 4444
 3     55555 55666 66666 66677 77777 77788 88888 89999 999
 4     00001 11111 11222 22223 33333 33334 44444 4
 4     56666 67777 77778 88889 99999
 5 M   00001 11112 22333 33344 44444
 5     55555 55556 66666 66667 77777 78888 88889 9999
 6     00001 11123 33333 44444 44444 4
 6     55555 56666 66666 66777 77888 88899 9
 7     00000 01111 22222 23344
 7     55556 67778 88888 889
 8     01222 22333 33344 4
 8 H   55666 67777 88899 99
 9     00001 11111 23344 4
 9     56677 77778 8889
10     00001 11224 444
10     55666 99
11     01112 2233
11     55667 77888 9999
12     00134 44
12     55566 77889 9
13     01113 33
13     57799
14     00224
14     89
15     02222 3
15     7
16     234
16     5
17     01
17     66668
18     77
19     01267
20     00
21     799
22     1489
24     4
25     345
26     7
28     7
33     0
44     2
89     1
93     5
99     8
```

	NMOC, ppmC
Cases	666
Minimum	0.078
Maximum	9.984
Mean	0.699
Standard Deviation	0.773
Standard Error	0.030
Skewness	7.037
Kurtosis	72.869
Lower Hinge (H)	0.310
Median (M)	0.531
Upper Hinge (H)	0.871

1870805R

Figure 5-7. Stem-and-leaf plot of the NMOC data for August, 1987.

```
  0     5699
  1     11122 2334
  1     55555 55666 77788 88999 9
  2     00011 11111 22222 22223 33344 44444 44444 4
  2     55555 56666 66667 77777 77778 88888 88999 99
  3     00001 11111 11222 22222 23333 33334 4444
  3 H   55555 55555 55666 66666 66667 77777 77778 88888 99999 9
  4     00000 00001 11111 22222 22222 23333 33444 4
  4     55555 55666 66677 77777 88888 88888 88888 88999 999
  5     00000 01111 11111 22222 22333 33344 44
  5     55556 66666 66677 77788 88889 99999 9999
  6 M   00000 01111 11222 22222 33444 44
  6     55555 55666 66677 77788 88899 9
  7     00000 01111 11122 22333 33333 44444 44
  7     55666 66667 77777 88899 99
  8     00001 11222 23333 33444 4444
  8     66667 77778 899
  9     00000 01111 11122 22223 33333 34
  9 H   55556 66677 77888 99999
 10     00011 12333 34
 10     55666 77889 9999
 11     00001 22233 344
 11     55566 77889 99
 12     00113 4
 12     55568 8999
 13     00011 1344
 13     6677
 14     11233
 14     55555 77888 999
 15     12
 15     6899
 16     01122 222
 16     569
 17     244
 17     56789
 18     0224
 18     55
 19     39
 20     35568
 21     12356 78
 22     237
 23     357
 24     238
 25     37
 26     247
 27     3
 28     23
 29     9
 30     23566
 31     35
 32     1
 33     1
 34     7
 44     67
 82     6
107     6
```

	NMOC, ppmC
Cases	667
Minimum	0.053
Maximum	10.767
Mean	0.833
Standard Deviation	0.818
Standard Error	0.031
Skewness	5.324
Kurtosis	48.493
Lower Hinge (H)	0.378
Median (M)	0.625
Upper Hinge (H)	0.999

1870803R

Figure 5-8. Stem-and-leaf plot of the NMOC data for September, 1987.

	NMOC, ppmC
Cases	56
Minimum	0.319
Maximum	2.733
Mean	1.308
Standard Deviation	0.611
Standard Error	0.082
Skewness	0.226
Kurtosis	−0.905
Lower Hinge (H)	0.771
Median (M)	1.284
Upper Hinge (H)	1.773

```
0    333
0    45555
0 H  66666 7
0    88999 9
1    00011 1
1 M  22233 3
1    44455
1 H  66677
1    889
2    00000 01
2    233
2
2    7
```

1870800R

Figure 5-9. Stem-and-leaf plot of the NMOC data for October, 1987.

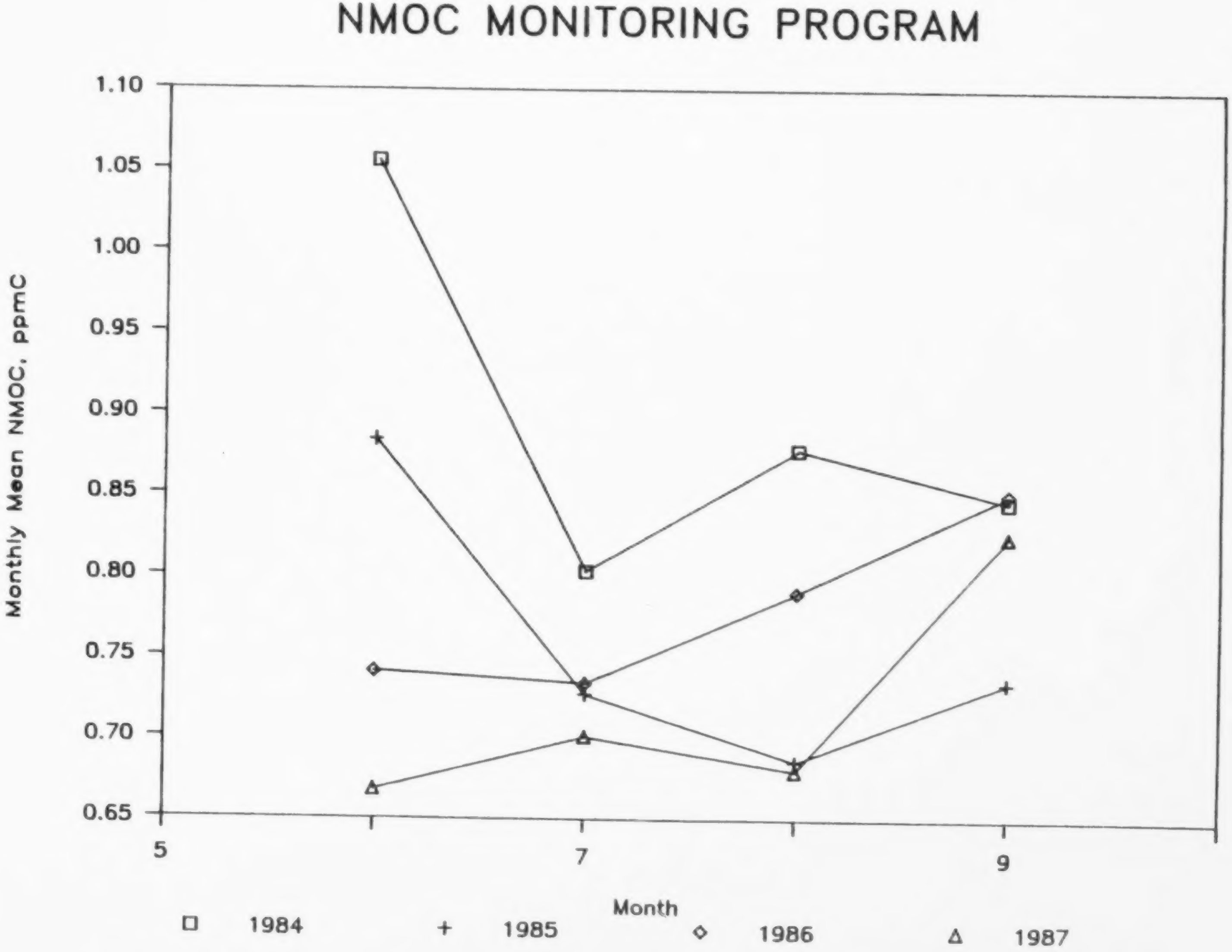

Figure 5-10. Monthly mean NMOC emissions for 1984, 1985, 1986, and 1987.

6.0 RECOMMENDATIONS

Based on the experiences and results of the 1987 NMOC Monitoring Study, certain recommendations redound with respect to equipment design and validation procedures.

6.1 EQUIPMENT DESIGN CHANGES

During the 1987 study and after testing several of the NMOC sampling timers, it was determined that several of the timers were not accurate in their initial and final operating time settings. It is recommended that the present NMOC mechanical sampling timers be tested for accuracy and precision. The task should include evaluation of cost effective timer alternatives.

Several of the 2-micron stainless steel filter holders installed in the NMOC sampling trains have failed by cracking at the attachment stem during the 1987 study. It is recommended to replace the present 1/8-inch stem filter holder in the NMOC sampling train with 1/4-inch stem filter holders.

A recommended analytical equipment design change is to replace the 6-port sample injection valves used in the HP-5880 gas chromatographs with similar valves of higher temperature rating. The valves could then be maintained at 130°C, which would facilitate their more reliable use with wet air samples.

6.2 OPERATING PROCEDURE CHANGES

At present all site samples contain some moisture. All zero air determinations use cleaned, dried air followed by two determinations using cleaned, dried air that has been humidified. Canister cleanup procedures also use cleaned, dried air that has been humidified. It is recommended that a well-designed study be conducted to determine whether moisture in a sample affects calibration and audit results, using propane standards. Current operating procedures call for the use of dry propane standards and external audit samples. The experimental design recommended would cover the present NMOC span of 0 to 9 ppmC, and at least 3 levels of humidity, zero, low (-10%) relative humidity and medium (-30%) relative humidity. The effect of humidity on propane calibration (and audit) results is currently unknown.

It is recommended to develop a procedure to certify the 3-hour NMOC sampling train for possible air toxics artifact addition. The NMOC sampling train was used in 1987 to collect ambient air samples for NMOC analysis, and for air toxics speciated analyses. A study has not been made to determine if the NMOC air sampling system itself contributes any target compounds for the air toxics determinations. The certification of the 3-hour sampling train should be similar to the certification performed on the 24-hour Urban Toxics Monitoring Program sampling train.

It is recommended to develop and conduct a preseason NMOC performance audit for all analytical systems including Radian (4-PDFID channels), EPA-QAD (PDFID channel), and EPA-ASRL (GC speciation system). Performance acceptability should be determined prior to site sample collection and analysis.

It is recommended to schedule and perform NMOC field audits for each NMOC site for 1988. The field audit would be scheduled at random among the sites, within the limits of a cost effective routing of the person sent to conduct the audit. It would indicate the use of a standard of known NMOC concentration connected to the site sampling system and require a duplicate sample plus a trip blank for each site.

6.3 MULTILEVEL NMOC STUDY

In 1987 ambient air samples were taken at ground level (10 meters) and at the 1197-feet (364.9 m) level. It is recommended that the study continue at these two sampling altitudes and that at least one more level (at 100 m or some other appropriate height above ground level) be sampled at the same site location. At the same time site barometric pressure and site wind velocity and direction data should be obtained. The samples obtained should be analyzed for NMOC content as well as for the air toxics compound concentrations. The information gained from such a study would be useful in validating various atmospheric model prediction methods.

6.4 SEASONAL NMOC STUDIES

Data derived in a study qualifying NMOC and NO_x in seasons other than summer could be useful in understanding the relationship of NMOC to NO_x and meteorological conditions. Currently a year-round study for 24-hour air toxics ambient air samples is being conducted. No study is currently being done which determines seasonal NMOC concentration changes.

7.0 REFERENCES

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APPENDIX A

CYROGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID) METHOD

CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID) METHOD

FOR MEASUREMENT OF ATMOSPHERIC CONCENTRATIONS OF NON–METHANE ORGANIC COMPOUNDS (NMOC)

August 1985

Quality Assurance Division
Environmental Monitoring Systems Laboratory
Office of Research and Development
U. S. ENVIRONMENTAL PROTECTION AGENCY
Research Triangle Park, North Carolina 27711

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Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

INTRODUCTION

A variety of photochemical dispersion models have been developed to describe the quantitative relationships between ambient concentrations of precursor organic compounds and subsequent downwind concentrations of ozone.[1] An important application of such models is to determine the degree of control of such organic compounds that is necessary in a particular area to achieve compliance with applicable ambient air quality standards for ozone.[1,2] For this purpose, the models require measurements of atmospheric concentrations of non-methane organic compounds (NMOC).

The more elaborate theoretical models generally require detailed organic species data.[2,3] Such species data must be obtained by multicomponent gas chromatographic (GC) analysis of air samples.[2,3] Simpler empirical models such as the Empirical Kinetic Modeling Approach (EKMA) require only total NMOC concentration data, specifically the average total NMOC concentrations from 6 AM to 9 AM daily.[2]

For many EKMA applications, NMOC measurements are required at urban, center-city-type sites.[2] The NMOC concentrations typically found at such urban sites may range up to 5-7 ppmC* or higher. If transport of precursors into an area is to be considered, then NMOC measurements upwind of the area are necessary.[1] Upwind NMOC concentrations are likely to be very low, (less than a few tenths of 1 ppm). Continuous commercially available NMOC analyzers have been used to measure NMOC for EKMA applications, but the measurements have generally been only marginally adequate for urban sites and unacceptable for upwind sites.[4,5] NMOC GC species measurements can be used by summing the various components to obtain a total NMOC concentration.[2] But for EKMA, the species data are not needed, and the cost and complexity of species analysis is very high.

---

*By convention, concentrations of NMOC are reported in units of parts per million carbon (ppmC), which for a specific compound is the concentration by volume (ppmV) multiplied by the number of carbon atoms in the compound.

The method described herein can be used to obtain both the requisite urban, as well as upwind, NMOC measurements.[6,7,8] This method is a simplification of the GC speciation method mentioned above. It combines the cryogenic concentration technique used in the GC method for high sensitivity with the simple flame ionization detector (FID) for total NMOC measurements, without the GC columns and complex procedures necessary for species separation. And because of the use of helium carrier gas, the FID has less response variation to various organic compounds than a conventional NMOC analyzer with air carrier or direct sample injection into the FID.[4,8]

This method can be used either for direct, in situ ambient measurements or for analysis of integrated samples contained in metal canisters. Making direct measurements at the monitoring site avoids the need for collection of air samples in canisters. However, the analyst must be present during the 6 AM to 9 AM period, and repeated measurements (approximately six per hour) must be taken to obtain the 6 AM to 9 AM average NMOC concentration. A separate analytical system and analyst is needed for each monitoring site. (Further development of the method may eventually allow for automatic operation, for on-line semi-continuous analysis in the future.)

The use of sample canisters allows the collection of integrated air samples over the 6 AM to 9 AM period by automated samplers at unattended monitoring sites. One analytical system can then be used to analyze the samples from several monitoring sites. Degradation or contamination of the air samples by the canister or sample collection system could be a potential problem. However, tests indicate that the use of properly cleaned stainless steel canisters, as described in the procedure, is practical and adds relatively little additional variability to the method.[8] Although storage of the air samples for several weeks in the stainless steel canisters appears to result in no appreciable degradation of the sample,[8] good practice would suggest that the samples be analyzed as soon after collection as practical.

CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID) METHOD FOR MEASUREMENT OF ATMOSPHERIC CONCENTRATIONS OF NON-METHANE ORGANIC COMPOUNDS (NMOC)

1. APPLICABILITY

This method is applicable to measurement of concentrations of total gaseous non-methane organic compounds (NMOC) in the atmosphere for use with atmospheric photochemical models such as EKMA[1] or for other appropriate applications. Measurements may be obtained either in situ, or by subsequent analysis of integrated air samples collected over a fixed time period, such as the 3-hour (6 AM to 9 AM) measurements specified for EKMA. Collection of integrated samples also allows for central analysis of samples from multiple sites. The high sensitivity and low detection limit of the method make it suitable for upwind measurements, while the wide dynamic range allows analysis of urban air samples as well.

2. PRINCIPLE

An air sample is taken either directly from the ambient air at the monitoring site, where the analytical system is located, or from a special sample canister filled previously at a remote sampling site. A fixed-volume portion of the sample is drawn at a low flow rate through a glass beaded trap that is cryogenically cooled to approximately -186° C (liquid argon temperature). At this temperature, all organic compounds in the sample other than methane are collected (either via condensation or adsorption) in the trap, while methane, nitrogen, oxygen, etc., pass through. The system is dynamically calibrated so that the volume of sample passing through the trap does not have to be quantitatively measured, but must be precisely repeatable between the calibration and analytical phases.

After the fixed volume air sample has been drawn through the trap, a helium carrier gas flow is diverted to pass through the trap, in the opposite direction to the previous sample flow, and into a flame ionization detector (FID). When the residual air and methane have been cleared from the trap and the FID baseline becomes steady, the cryogen is removed and the temperature of the trap is raised to approximately 90° C. The organic compounds previously collected in the trap revolatilize and are carried into the FID, resulting in a response peak or peaks from the FID. The area of the peak or peaks is integrated, and the integrated value is translated to concentration units via a previously obtained calibration curve relating integrated peak areas with known concentrations of propane.

The cryogenically cooled trap simultaneously concentrates the non-methane organic compounds while separating and removing the methane from air samples. Thus the technique is direct reading for NMOC and, because of the concentration step, is more sentitive than conventional NMOC analyzers. Also, operation of the FID detector with a helium carrier results in less response variation to different organic compounds[6,8] than is observed with conventional NMOC analyzers having air carriers or direct air injection.[4] Quantitative trapping has been shown for most compounds tested.[6,8]

3. PRECISION AND ACCURACY

The analytical precision, assessed in an actual field monitoring project, was estimated to be 12.7%.[8] The overall precision estimate for the method, including the effect of collecting and storing the ambient samples in stainless steel canisters, was found to be about 0.12 ppmC (approximately 17.4%).[8] Because of the number and variety of organic compounds included in the NMOC measurement, determination of absolute accuracy is not practical. Based on comparison with manual GC speciation analysis--a technique regarded as the best available for the measurement of atmospheric organic compounds--the proportional (per cent) bias was determined to be +8.1%, with a negligible fixed bias (intercept).[8] Although the 8.1% bias was statistically significant, no correction factor is proposed for the method because this bias is modest, and the speciation technique is not an absolute standard.

Experimental tests indicate some degree of FID baseline shift from water vapor in ambient samples, which could result in positive bias, variability, or both. These problems can be adequately minimized by careful selection of the integration termination point and appropriate baseline corrections, as described in Section 7.3.

4. APPARATUS

The following components and materials are required or recommended. Sources for the more specialized components are given in the Appendix. An overall schematic diagram of the analytical system is shown in Figure 1, and a suggested system for collecting ambient samples in canisters is shown in Figure 2. A canister cleaning system is shown in Figure 3.

4.1 Air Sampling

4.1.1 Sample manifold or sample inlet line, to bring sample air into the sampling or analytical system.

4.1.2 Vacuum pump or blower, if needed, to draw sample air through a sample manifold or long inlet line to reduce inlet residence time.

4.2 Sample Collection in Pressurized Canisters (See Figure 2)

4.2.1 Sample canisters. Stainless steel pressure vessels of 4 to 6 L volume, with one or two leak-free shut-off valves (see Appendix). Interior surfaces of the canisters should be passivated using the SUMMA process (Molectrics, Carson, CA). Each canister should have a unique identification number.

4.2.2 Sample pump. Stainless steel, metal bellows type (Metal Bellows model MB-151 or equivalent) capable of 2 atmospheres (200 kPa, 30 psig) minimum output pressure. Pump must be free of leaks, clean, and uncontaminated by oil or organic compounds.

4.2.3 Pressure gauge. 0-200 kPa (0 - 30 psig).

4.2.4 Shut-off valve, for gauge.

4.2.5 Stainless steel orifice or short capillary, capable of maintaining a substantially constant flow over the sampling period (see Section 6.2).

4.2.6 Particulate matter filter. (2 micron stainless steel sintered in-line type)

4.2.7 Timer (for unattended sample collection). Capable of controlling pump(s) and solenoid valve (see Section 6.2).

4.2.8 Solenoid valve. Normally closed, bubbletight, electrically-operated valve. A special bi-stable solenoid valve that requires enerigizing only briefly for turn-on and turn-off (Skinner Magnalatch or equivalent) is recommended to minimize temperature rise in the valve (see Section 6.2).

4.2.9 Needle valve. Optional fine metering valve may be needed to adjust flow rate of sample from canister during analysis.

4.3 Sample Canister Cleaning (See Figure 3)

4.3.1 Vacuum pump. Capable of evacuating the sample canisters to an absolute pressure of <5 mm Hg.

4.3.2 Vacuum manifold. A metal manifold with connections for several canisters to be simultaneously cleaned.

4.3.3 Shut-off valves (3), as shown.

4.3.4 Vacuum gauge. Capable of measuring the vacuum in the vacuum manifold to an absolute pressure of 5 mm Hg or less.

4.3.5 Cryogenically cooled trap. U-shaped open tubular trap cooled with liquid nitrogen or argon, to prevent contamination from back diffusion of oil from the vacuum pump.

4.3.6 Pressure gauge. 0 - 50 psig (0-345 kPa), to monitor canister pressure.

4.3.7 Flow control valve, to regulate flow of zero air into canisters.

4.4 Analytical System (See Figure 1)

4.4.1 FID detector system, including flow controls for the FID fuel and air, temperature control for the FID, and signal processing electronics.

4.4.2 Chart recorder, compatible with the FID output signal, to record FID response signals for visual interpretation.

4.4.3 Integrator, electronic, compatible with the FID output signal and capable of integrating the area of one or more FID response peaks and calculating peak area corrected for baseline drift (see Section 6.3.10).

NOTE: Items 4.4.1, 4.4.2, and 4.4.3 are conveniently provided by a current model laboratory chromatograph (such as the Hewlett-Packard model 5880 or similar). See also Sections 6.3.7 and 6.3.10. A chromatograph may also provide other convenient features such as an oven for warming the trap and valve, automatic control of the valve and integrator, pressure or flow regulators, etc. (see below).

4.4.4 Six-port chromatographic valve. Seiscor model VIII (pneumatic), Valco 9110 (manual), or equivalent.

4.4.5 Trap (See Figure 4). Fabricated from 0.3175 cm (1/8") o.d., 0.21 cm i.d. chromatographic grade stainless steel tubing to the approximate dimensions shown. A 7 to 10 cm section in the center of the trap is packed with 60/80 mesh glass beads, held in place with dimethyldichlorosilane-treated glass wool at both ends.

4.4.6 Cylinder pressure regulators. Standard, two-stage cylinder pressure regulator, with pressure gauges, for helium, air and hydrogen cylinders.

4.4.7 Low pressure regulators. Single stage, with pressure gauge, if needed, to maintain constant helium carrier gas and hydrogen flow rates (see Section 6.3.5).

4.4.8 Needle valve. Fine metering valve to adjust sample flow rate through trap.

4.4.9 Cryogenic Dewar, to hold liquid cryogen sized to contain submerged portion of trap.

4.4.10 Absolute pressure gauge. 0 - 400 mm Hg, Wallace & Tiernan model 61C-ID-0410, or equivalent (see Section 6.3.1).

4.4.11 Vacuum reservoir. Vacuum tank of about 1 to 2 L capacity (see Section 6.3.1).

4.4.12 Gas purifiers. Gas scrubbers containing Drierite or silica gel and 5A molecular sieve to remove moisture and organic impurities in the helium carrier gas, air, and hydrogen.

4.4.13 Shut-off valves (2). Leak free, for vacuum valve and sample valve.

4.4.14 Vacuum pump. General purpose laboratory pump capable of evacuating the vacuum reservoir to an appropriate vacuum that allows the desired sample volume to be drawn through the trap.

4.4.15 Trap heating system. Chromatograph oven, hot water, or other means to heat the trap to 80° to 90° C.

4.4.16 Vent, to keep the trap at atmospheric pressure during trapping when using pressurized canisters, with means to detect and verify positive vent flow, such as a rotameter or bubbler (see Section 6.2).

4.5 Other Materials

4.5.1 Various connecting tubing and plumbing fittings. All such items in contact with the sample, analyte, or support gases prior to analysis should be stainless steel or other inert metal. Do not use plastic or Teflon tubing or fittings.

4.5.2 Various mechanical mounting fixtures, as necessary.

5. SUPPLIES

5.1 Helium. Cylinder of high purity grade helium.

5.2 Combustion air. Cylinder of air containing less than 0.5 ppm hydrocarbons, or equivalent air source.

5.3 Hydrogen. Cylinder of ultra high purity grade hydrogen, or equivalent hydrogen source.

5.4 Propane calibration standard. Cylinder containing 1 to 100 ppm (3 to 300 ppmC) propane in air. The cylinder assay should be traceable to a National Bureau of Standards (NBS) propane in air Standard Reference Material (SRM) or to a commercially available Certified Reference Material (CRM).

5.5 Zero air, containing less than 0.01 ppmC hydrocarbons. Zero air may be obtained from a cylinder of zero-grade compressed air scrubbed with Drierite or silica gel and 5A molecular sieve or activated charcoal, or by catalytic cleanup of ambient air. All zero air should be passed through a cryogenic cold trap for final cleanup.

5.6 Cryogen. Liquid argon or liquid oxygen. (Observe appropriate safety precautions with liquid oxygen.)

6. SYSTEM DESCRIPTION

6.1 Direct Sampling

For direct ambient sampling, the cryogenic trapping system draws the air sample directly from a pump-ventilated distribution manifold or sample line. The connecting line should be of small diameter (1/8" o.d.) stainless steel and as short as possible to minimize its dead volume. With direct sampling, multiple analyses will have to be taken over the sampling period to establish hourly or 3-hour NMOC concentration averages.

6.2 Sample Collection in Pressurized Canisters

Collection of ambient air samples in pressurized canisters provides a number of advantages, including (1) convenient integration of ambient samples over a specific time period, e.g., 1 or 3 hours; (2) remote sampling and central analysis; (3) storage and shipping of samples, if necessary; (4) unattended sample collection; (5) analysis of samples from multiple sites with one analytical system; and (6) collection of replicate samples for assessment of measurement precision. However, great care must be exercised in selecting, cleaning, and handling the sample canisters and sampling apparatus to avoid losses or contamination of the samples.

Figure 2 shows a schematic diagram of a recommended sample collection system. The small auxiliary vacuum pump purges the inlet manifold or lines with a flow of several liters/minute to minimize the sample residence time. The larger, metal bellows pump takes a small portion of this sample to fill and pressurize the sample canister. Both pumps should be shock-mounted to minimize vibration.

A critical orifice or hypodermic needle connected to the inlet of the metal bellows pump is used to maintain a substantially constant flow into the canister(s) over the sample period and must be selected to provide the desired flow rate. This flow rate is chosen so that the canisters are pressurized to at least one atmosphere above ambient pressure (2 atmospheres absolute pressure) over the desired sample period. The flow rate can be calculated by

$$F = \frac{P\ V\ N}{T \times 60} \qquad (1)$$

where

F = Flow rate, cm^3/min,

P = Final canister pressure, atmospheres absolute*,

V = Volume of the canister, cm^3,

N = Number of canisters connected together for simultaneous sample collection,

T = Sample period, hours.

For example, if one 6 L canister is to be filled to 2 atmospheres absolute pressure (15 psig) in 3 hours,

$$F = \frac{2 \times 6000 \times 1}{3 \times 60} = 67 \ cm^3/min$$

A 30 gauge hypodermic needle 2.5 cm long provides a flow of approximately 65 cm^3/min with the Metal Bellows Model MB-151 pump. Such a needle will maintain approximately constant flow up to a canister pressure of about 10 psig, after which the flow drops with increasing pressure. At 15 psig (2 atmospheres absolute pressure), the flow is about 10% below the original flow.

The hypodermic needle is protected with a 2.0 μm stainless steel in-line particulate filter, which also keeps particulate matter from depositing in the pump, lines, and canister. A suggested filter-hypodermic needle assembly can be fabricated as shown in Figure 6.

For automatic operation, the timer is wired to start and stop the pump or pumps at the appropriate times for the intended sample period.

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*Absolute pressure in atmospheres = $P_g/P_a + 1$, where Pg = gauge pressure in the canister, psig, and Pa = standard atmospheric pressure (14.7 psi).

The timer must also control the solenoid valve. The Skinner Magnelatch solenoid valve specified avoids the substantial temperature rise that would occur with a conventional normally closed solenoid valve, which would have to be energized during the entire sample period. This temperature rise in the valve could cause outgasing of organics from the Viton valve seat material. The Magnelatch valve, however, requires only brief electrical pulses to open and close at the appropriate start and stop times and therefore experiences no temperature increase. The pulses may be obtained with an electronic timer that can be programmed for short (5 to 60 seconds) ON periods or with a conventional mechanical timer and a pulse circuit such as the one shown in Figure 7.

The canisters are originally evacuated. The connecting lines between the sample pump and the canister(s) should be as short as possible to minimize their volume. Check to see that the flow rate into the canister remains relatively constant over the entire sampling period. (As previously noted, some drop in the flow rate may occur near the end of the sample period as the canister pressure approaches two atmospheres absolute pressure.)

Simultaneous collection of duplicate samples decreases the possibility of lost measurement data from samples lost due to leakage or contamination in either of the canisters. Two (or more) canisters can be filled simultaneously by connecting them in parallel (see Figure 2) and selecting an appropriate flow rate to accommodate the number of canisters (Equation 1). Duplicate (or replicate) samples also allow assessment of measurement precision based on the differences between duplicate samples (or the standard deviation among replicate samples).

Prior to field use, each sampling system should be tested for pump contamination (see Section 7.2), leaks, and proper flow rate. The plumbing on the outlet side of the metal bellows pump can be checked for leaks by shutting off the canister valves, pressurizing the system, and checking fittings, etc. with a nonhydrocarbon-based leak detector fluid. The metal bellows pump should also be leak-checked by plugging its outlet and ensuring that there is no flow into its inlet side. The canisters must be cleaned and checked for contamination before use (see Section 7.1).

During analysis, a pressurized canister containing an air sample is connected to the six-port valve with a vent, as shown in Figure 1. The canister valve or an optional flow control valve installed between the canister and the vent is used to reduce the canister pressure and adjust the canister flow rate to a value slightly higher than the trap flow rate set by sample metering valve. The excess flow exhausts through the vent, which assures that the sample air flowing through the trap is at atmospheric pressure. The vent is connected to a flow indicator such as a rotameter or is submerged in water so that the escaping bubbles provide a visual indication of vent flow to assist in adjusting flow control valve.

6.3 Analytical System

6.3.1 Sample volume metering system. The vacuum reservoir and pressure gauge (see Figure 1) are used to meter precisely repeatable volmes of sample air through the cryogenically cooled trap. With the sample valve closed and the vacuum valve open, the reservoir is first evacuated with the vacuum pump to a predetermined pressure (e.g. 80 mm Hg). Then the vacuum valve is closed and the sample valve is opened to allow sample air to be drawn through the cryogenic trap and into the evacuated reservoir until a second predetermined reservoir pressure is reached (e.g. 180 mm Hg). The (fixed) volume of air thus sampled is determined by the pressure rise in the vacuum reservoir (difference between the predetermined pressures) as measured by the absolute pressure gauge. This volume can be calculated by

$$V_s = \frac{\Delta P \ V_r}{P_s} \qquad (2)$$

where

V_s = Volume of air sampled, standard cm^3,

ΔP = Pressure difference measured by gauge, mm Hg,

V_r = Volume of vacuum reservoir,

P_s = Standard pressure (760 mm Hg).

For example, with a vacuum reservoir of 1700 cm^3 and a pressure change of 100 mm Hg (80 to 180 mm Hg), the volume sampled would be 225 cm^3.

The sensitivity of the method is proportional to the sample volume. However, sample volumes over about 500 cm^3 may lead to loss of sample flow during trapping due to clogging of the trap from ice. Sample volumes below about 100 - 150 cm^3 may cause increased measurement variability due to dead volume in lines and valves. For most typical ambient NMOC concentrations, sample volumes in the range of 200 - 500 cm^3 appear to be appropriate. If a response peak obtained with a 500 cm^3 sample turns out to be off-scale or to exceed the calibration range, a second analysis can be carried out with a smaller volume. The actual sample volume used need not be accurately known if it is precisely repeatable during both calibration and analysis.

Similarly, the actual volume of the vacuum reservoir need not be accurately known. But the reservoir volume should be matched to the pressure range and resolution of the absolute pressure gauge so that the measurement of the pressure change in the reservoir--and hence the sample volume--is repeatable within 1%. A 1700 cm^3 vacuum reservoir and pressure change of 20 to 200 mm Hg, measured with the specified pressure gauge, has proven adequate. A smaller volume reservoir may be used with a greater pressure change to accommodate absolute pressure gauges with lower resolution, and vice versa.

6.3.2 Trap. The trap should be carefully constructed from a single piece of tubing in the shape shown in Figure 4. The central portion of the trap (7 to 10 cm) is packed with 60/80 mesh glass beads with small glass wool plugs to retain the beads. The trap must fit conveniently into the Dewar flask (Section 4.4.9), and the arms must be of an appropriate length to allow the beaded portion of the trap to be submerged below the level of liquid cryogen in the Dewar. The trap should connect directly to the six-port valve, if possible, to minimize line length between the trap and the FID. It must be mounted to allow the Dewar to be conveniently slipped on and off the trap and also to facilitate heating of the trap (see Section 6.3.4).

6.3.3 Liquid cryogen. Either liquid oxygen (bp -183.0° C) or liquid argon (bp -185.7° C) may be used as the cryogen; experiments have shown no difference in trapping efficiency between the two cryogenic liquids.[6] However, appropriate safety precautions must be taken if liquid oxygen is used. Liquid nitrogen (bp -195° C) should not be used as it causes condensation of oxygen and methane in the trap. It may be possible to use liquid nitrogen in an automated system if an automatic temperature controller is used to obtain an operational temperature in the range of -180° to -185° C. The level of the cryogenic liquid should be maintained constant with respect to the trap (see Section 7.3.11) and should completely cover the beaded portion of the trap.

6.3.4 Heat source. To facilitate integration of the NMOC response peak, a hot bath or other heating source is used to heat the trap and volatilize the concentrated NMOC such that the FID produces one (or only a few) sharp and easily integrated peak (or peaks). The trap should be heated to a temperature in the range of 80° to 90° C. A simple heating source for the trap is a beaker or Dewar filled with water maintained at 80° to 90° C. Other types of heat sources include a temperature-programmed chromatograph oven, electrical heating of the trap itself, or any type heater that brings the temperature of the trap up to 80° to 90° C in 1 to 2 minutes. A uniform trap temperature rise rate (above 0° C) may help to reduce variability and facilitate more accurate correction for the moisture-shifted baseline (see Section 6.3.10). If a programmable chromatograph oven is used to heat the trap, the following parameters have been found to be acceptable: initial temperature, 30° C; initial time, 0.20 minutes (following start of the integrator); heat rate, 30°/min.; final temperature, 90° C.

6.3.5 Carrier gas. Helium is used to purge residual air and methane from the trap at the conclusion of the sampling phase and to carry the revolatilized NMOC from the trap into the FID. A single-stage auxiliary regulator between the cylinder and the analyzer may not be necessary but is recommended to regulate helium pressure better than the two-stage cylinder regulator. When an auxiliary regulator is used, the secondary stage of the two-stage regulator must be set at a pressure higher than the pressure setting of the single-stage regulator.

6.3.6 Construction. The six-port valve and as much of the interconnecting tubing as practical should be located inside an oven or otherwise heated to 80° to 90° C to minimize wall losses or adsorption/desorption in the connecting lines. All lines should be kept as short as practical.

All tubing used for the system should be chromatographic grade stainless steel connected with stainless steel fittings. Pneumatic damping may be needed between the six-port valve and the FID to dampen the effect of valve actuations, which may otherwise cause upsets in the FID signal or extinguish the flame. A stainless steel capillary may be used for damping, but its length should be as short as possible to prevent broadening of the peak.

After assembly, the system should be pressurized to about 80 psig (550 kPa) and checked for leaks. During this procedure, disconnect the absolute pressure gauge and cap the line to prevent damage to the gauge. If the system is leak free, depressurize the system and reconnect the gauge.

6.3.7 FID Detector. The FID burner air, hydrogen, and carrier helium flow rates should be set according to the manufacturer's instructions to obtain an adequate FID response while maintaining as stable a flame as possible throughout all phases of the analytical cycle. Typical flow rates are as follows: hydrogen, 30 cm^3/min; carrier (He), 30 cm^3/min; burner air, 400 cm^3/min.

6.3.8 Linearity. Response has been shown to be linear over a wide range (0 to 10,000 ppb C).[6]

6.3.9 Range. Some FID detector systems such as those associated with laboratory chromatographs may have autoranging. Others may provide a "range" (attenuator) control and internal full-scale output voltage selectors. An appropriate combination should be chosen so that an adequate output level for accurate integration is obtained down to the detection limit, yet the electrometer or integrator must not be driven into saturation at the upper end of the calibration. Saturation of the electrometer may be indicated by flattening of the calibration curve at high concentrations. Additional adjustment of range and sensitivity can be provided by adjusting the sample volume used, as discussed in Section 6.3.1.

6.3.10 Integrator. The integrator must be electrically compatible with the output signal of the FID detector so that sufficient resolution is available at low concentrations without overranging on high concentrations. If both an integrator and a separate chart recorder are used, care must be exercised to be sure that these components do not interfere with each other electrically. Range selector controls on both the integrator and the FID analyzer may not provide accurate range ratios, so individual calibration curves should be prepared for each range to be used.

The integrator should be capable of marking the beginning and ending of peaks, constructing the appropriate baseline between the start and end of the integration period, and calculating the peak area accordingly (see Figure 5). This capability is necessary because the moisture in the sample, which is also concentrated in the trap, will cause a slight positive baseline shift. This baseline shift starts as the trap warms and continues until all of the moisture is swept from the trap, at which time the baseline returns to its normal level. The shift generally continues longer than the ambient organic peaks. If possible, the integrator should be programmed to correct for this shifted baseline. Alternatively, analyses of humidified zero air should be used as blanks to correct the ambient air concentration measurements accordingly.

7. PROCEDURE

7.1 Recommended Procedure for Canister Cleaning

7.1.1 Leak-test all canisters by pressurizing them to about 40 psig (275 kPa) with zero air and immersing them in water. Defective canisters should be returned to the manufacturer for repair.

7.1.2 Connect canisters to the vacuum manifold as shown in Figure 3.

7.1.3 Open the vacuum shut-off valve and evacuate the canisters to 5.0 mm Hg or less for one hour or more, using a cryogenically-cooled trap in the vacuum line to eliminate back diffusion of hydrocarbons and oil from the vacuum pump.

7.1.4 Close the vacuum and vacuum gauge shut-off valves. Open the zero air valve to pressurize the canisters with zero air to about 35 psig (240 kPa). If a zero gas generation system is used, the rate of flow may need to be limited to maintain the zero air quality.

7.1.5 Close the zero air valve and allow the canisters to vent down to atmospheric pressure through the vent valve. Then close the vent valve.

7.1.6 Repeat steps 7.1.3 to 7.1.5 two additional times.

7.1.7 Fill the canisters with zero air and analyze the contents as a blank check of the canisters and of the cleanup system and procedure. This step should be performed on 100% of the canisters until the cleanup system and procedure are proven to be reliable. The check can then be reduced to a lower percentage unless problems arise. Any canister that does not test clean (compared to direct analysis of zero air) after repeated cleaning should not be used.

7.1.8 Re-evacuate the canister after the analysis and leave it evacuated until used.

7.1.9 Attach a paper tag to each canister for field notes. The canister is now ready for collection of an air sample.

7.2 Procedure for Collection of Samples in Canisters

7.2.1 Clean and test the canisters according to the procedure in Section 7.1.

7.2.2 Assemble a sample collection system such as the one shown in Figure 2.

7.2.3 Check the pump for contamination by filling two evacuated, cleaned canisters with zero air through the sampling system and analyzing them.

7.2.4 Check the flow control orifice on each sampling system to make sure the sample flow remains relatively constant up to about 15 psig (2 atmospheres absolute pressure).

7.2.5 Install the pump at the site. If the inlet line is long (over about 3 meters), use an auxiliary pump as shown in Figure 2 to ventilate the line.

7.2.6 Verify that the timer, pump(s), and solenoid valve are connected and operate properly.

7.2.7 Verify that the timer is correctly set for the desired sample period, and that the solenoid valve is closed. Connect the evacuated canister(s) to the solenoid valve.

7.2.8 Open the canister valve. A small rotameter temporarily connected to the sample inlet can be used to verify that there is no flow. (Flow detection would indicate a leaking solenoid valve.)

7.2.9 After the sample period, close the canister valve, disconnect the canister from the sampling system and connect a pressure gauge to the canister. Briefly open and close the canister valve, and note the canister pressure. If the canister pressure is not approximately 2 atmospheres absolute (15 psig), determine and correct the cause of the low or high sample pressure before the next sample.

7.2.10 Fill out the identification tag on the sample canisters as necessary. Take the canisters to the analytical system for analysis.

7.2.11 Complete records of the sampling should be entered in a laboratory notebook. The sampling operator should be alerted to take note of any activities or special conditions in the area (rain, smoke, etc.) that may affect the sample contents.

7.3 Analysis Procedure

7.3.1 Assemble the analytical system as shown in Figure 1 and as discussed in Section 6. Allow the FID detector to warm up and stabilize for several hours before analysis.

7.3.2 Check and adjust the helium carrier pressure to provide the correct carrier flow rate for the system (see Section 6.3.7). Also check FID hydrogen and burner air flow rates.

7.3.3 Close the sample valve and open the vacuum valve to evacuate the vacuum reservoir.

7.3.4 With the trap at room temperature, place the six-port valve in the inject position.

7.3.5 Open the sample valve and adjust the sample metering valve for an approximate sample flow of 50 - 100 cm^3/min. (The flow will be lower later, when the trap is cold.)

7.3.6 Connect a sample canister or direct sample inlet to the six-port valve as shown in Figure 1. For a canister, open the canister valve and adjust the canister valve and/or the sample metering valve to obtain a moderate vent flow as indicated by the flow indicator or by constant bubbles. Then close the sample valve.

CAUTION: Do not allow water to be drawn into the six-port valve. The sample flow will be lower (and hence the vent flow will be higher) when the trap is cold.

7.3.7 Open the vacuum valve (if not already open) to evacuate the vacuum reservoir. With the six-port valve in the inject position and the vacuum valve open, open the sample valve for a few minutes to flush and condition the inlet lines.

7.3.8 Close the vacuum valve and allow the reservoir pressure to rise to the predetermined sample starting pressure on the absolute pressure gauge (see Section 6.3.1). Then quickly close the sample valve at the starting pressure reading.

7.3.9 Switch the six-port valve to the sample position.

7.3.10 Submerge the trap in the cryogen and allow a few minutes for the trap to cool completely (indicated when the cryogen stops boiling). Check and adjust the initial cryogen level to the same level used during calibration (Section 8).

7.3.11 Open the sample valve and observe the increasing pressure on the pressure gauge. When it reaches the pressure representative of the desired sample volume (see Section 6.3.1), close the sample valve.

7.3.12 Add a little cryogen or elevate the Dewar to raise the liquid level to a point slightly (1 to 5 mm) higher than the initial level at the beginning of the trapping (see Section 7.3.8). Then switch the 6-port valve to the inject position, keeping the cryogenic liquid on the trap. Also close the canister valve to conserve the remaining sample in the canister.

7.3.13 Start the chart recorder and wait until the FID response baseline has stabilized (about 20 to 60 seconds). Do not wait longer than one minute.

7.3.14 Start the integrator. Remove the liquid cryogenic bath from the trap and smoothly but not too quickly replace it with a Dewar of hot water (approximately 80° to 90° C) or, if the trap is in an oven, start heating the oven. Use the same temperature and level of hot water or a consistent heating sequence for both calibration and sample analyses. Heating the trap too quickly may cause an initial negative-going response which could hamper accurate integration. Some initial experimentation may be necessary to determine the optional heating procedure for each system, but once established, the procedure should be consistent for each analysis.

7.3.15 Continue the integration only long enough to include all of the organic compound peaks and to establish the end point FID baseline, as shown in Figure 5 (probably 1 to 2 minutes, depending on rate of trap heating). The end point baseline will be shifted somewhat higher than the initial baseline due to moisture in the sample. Construct an operational baseline from the initial baseline at the beginning of the first peak to the end point baseline as shown in Figure 5, and correct the peak area reading according to this operational baseline. Electronic integrators either do this automatically or they should be programmed to do this correction.

NOTE: Be sure that the 6-port valve remains in the inject position until all moisture has purged from the trap (3 minutes or longer).

7.3.16 Use the calibration curve (Section 8.3) to convert the integrated peak area reading into concentration units (ppmC). Note that the NMOC peak shape may not be precisely reproducible due to variations in heating the trap, but the total NMOC peak area should be reproducible.

7.3.17 Duplicate Analysis - Analyze each canister sample at least two times and report the average NMOC concentration. Problems occasionally occur during an analysis that will cause improper or inconsistent results. If the first two analyses do not agree closely, additional analyses should be made to identify inaccurate measurements and produce a more accurate average.

8. CALIBRATION

8.1 Calibration Frequency

Initially, a complete dynamic calibration at five or more concentrations should be carried out on each range to define the calibration curve. Subsequently, the calibration should be verified with two- or three-point calibration checks (including zero) each time the analytical system is used to analyze samples.

8.2 Calibration Standards

Propane calibration standards may be obtained directly from low concentration cylinder standards or by dilution of high concentration cylinder standards with zero air. Dilution flow rates must be measured accurately, and the combined gas stream must be mixed thoroughly. Calibration standards should be sampled directly from a vented manifold or tee. Remember that a propane NMOC concentration in ppmC is three times the volumetric concentration in ppm.

8.3 Calibration Procedure

8.3.1 Select one or more combinations of FID attenuator setting, output voltage setting, integrator resolution (if applicable), and sample volume to provide the desired range or ranges (e.g., 0 to 1.0 ppmC or 0 to 5.0 ppmC). Each such range should be calibrated individually and have a separate calibration curve. (Modern GC integrators may provide automatic ranging such that several decades of concentration may be covered in a single range.)

8.3.2 Analyze each calibration standard three times according to the procedure in Section 7.3. Be sure that flow rates, pressure gauge start and stop readings, initial cryogen liquid level in the Dewar, timing, heating and other variables are the same as will be used during analysis of ambient samples.

8.3.3 Average the three analyses for each concentration standard and plot the calibration curve(s) as integrated peak area reading versus concentration in ppmC. The relative standard deviation for the three analyses should be less than 3% (except for zero concentration). Linearity should be expected; points that appear to deviate abnormally should be repeated. If non-linearity is observed, an effort should be made to identify and correct the problem. If the problem cannot be corrected, additional points in the non-linear region may be needed to adequately define the calibration curve.

9. METHOD MODIFICATIONS

9.1 Sample Metering System

Although the vacuum reservoir and absolute pressure gauge technique for metering the sample volume during analysis is efficient and convenient, other techniques should work also. For example, a constant sample flow could be established with a vacuum pump and a critical orifice, with the six-port valve being switched to the sample position for a measured time period. Or a gas volume meter such as a wet test meter could be used to measure the total volume of sample air drawn through the trap. However, these alternate techniques have not been tested or evaluated.

9.2 FID Detector System

FID detector systems other than the Hewlett-Packard Model 5840A may also be adaptable to the method. The specific flow rates and necessary modifications for the helium carrier for any alternate FID instrument would have to be worked out by the user.

9.3 Range

It may be possible to increase the sensitivity of the method by increasing the sample volume. However, limitations are likely to arise, such as plugging of the trap by ice; hence, any attempt to increase the sensitivity should be tested carefully.

10. REFERENCES

1. U. S. Environmental Protection Agency, "Uses, Limitations, and Technical Basis of Procedures for Quantifying Relationships Between Photochemical Oxidants and Precursors." EPA-450/2-77-021a (Nov. 1977).

2. U. S. Environmental Protection Agency, "Guidance for Collection of Ambient Non-methane organic Compound (NMOC) Data for Use in 1982 Ozone SIP Development." EPA-450-/4-80-011 (June 1980).

3. H. B. Singh, "Guidance for the collection and use of ambient hydrocarbons species data in development of ozone control strategies." U. S. Environmental Protection Agency, EPA-450/480-008 (April 1980).

4. F. W. Sexton, R. M. Michie, F. F. McElroy, V. L. Thompson, "A Comparative Evaluation of Seven Automated Ambient Non-methane Organic Compound Analyzers." U. S. Environmental Protection Agency, EPA-600/54-82-046 (August 1982).

5. H. G. Richter, "Analysis of Organic Compound Data Gathered During 1980 in Northeast Corridor Cities." U. S. Environmental Protection Agency, EPA-450/4-83-017 (August 1983).

6. R. K. M. Jayanty, A. Blackard, F. F. McElroy, W. A. McClenny, "Laboratory Evaluation of Non-methane Organic Carbon Determination in Ambient Air by Cryogenic Preconcentration and Flame Ionization Detection." U. S. Environmental Protection Agency, EPA-600/54-82-019 (July 1982).

7. R. D. Cox, M. A. McDevitt, K. W. Lee, G. K. Tannahill, "Determination of Low Levels of Total Non-methane Hydrocarbon Content in Ambient Air." Eniron. Sci. Technol. 16(1):57 (1982).

8. F. F. McElroy, V. L. Thompson, H. G. Richter, "A Cryogenic Preconcentration - Direct FID (PDFID) Method for Measurement of NMOC in the Ambient Air." U. S. Environmental Protection Agency, EPA-600/ (August 1985).

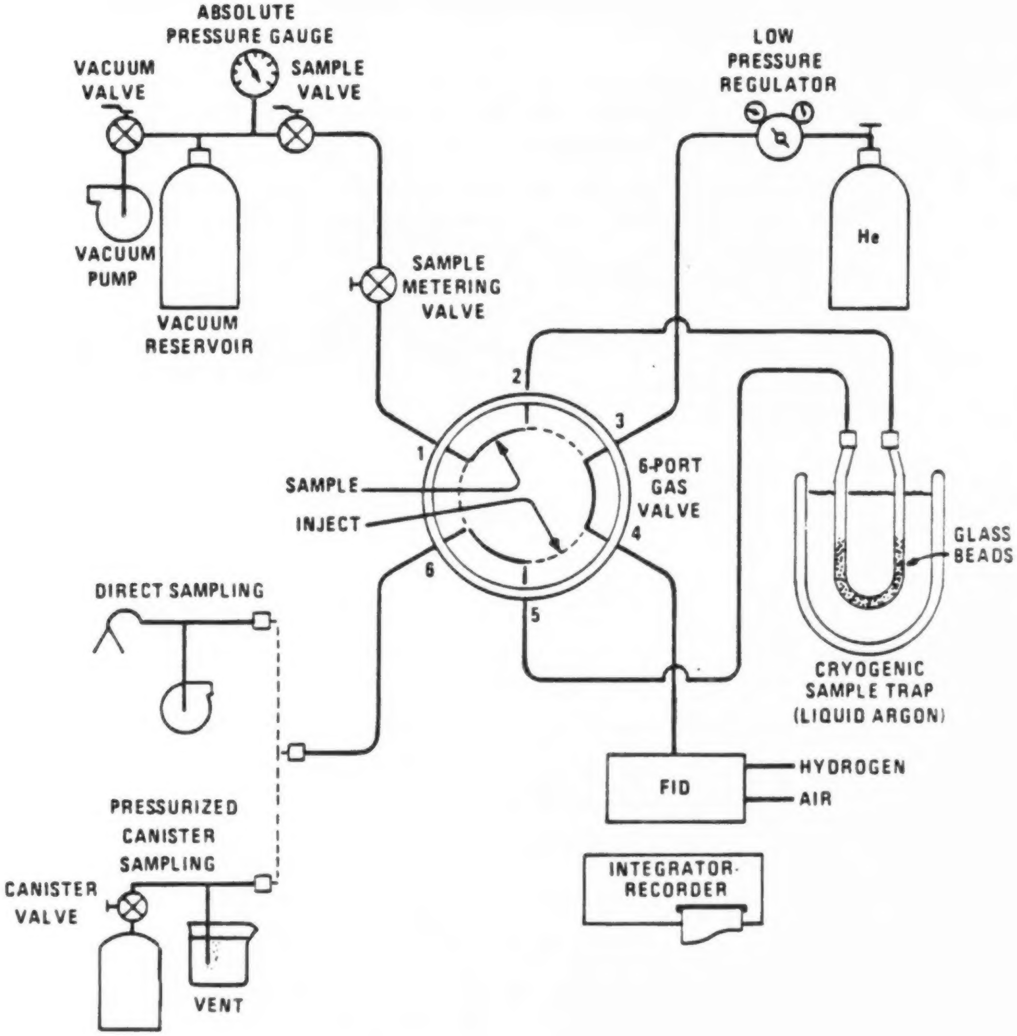
ABSOLUTE PRESSURE GAUGE
VACUUM VALVE
SAMPLE VALVE
VACUUM PUMP
VACUUM RESERVOIR
SAMPLE METERING VALVE
LOW PRESSURE REGULATOR
He
2
3
1
SAMPLE
INJECT
6-PORT GAS VALVE
4
6
5
GLASS BEADS
CRYOGENIC SAMPLE TRAP (LIQUID ARGON)
DIRECT SAMPLING
FID
HYDROGEN
AIR
INTEGRATOR-RECORDER
PRESSURIZED CANISTER SAMPLING
CANISTER VALVE
VENT

Figure 1. Schematic diagram of analysis system showing two sampling modes.

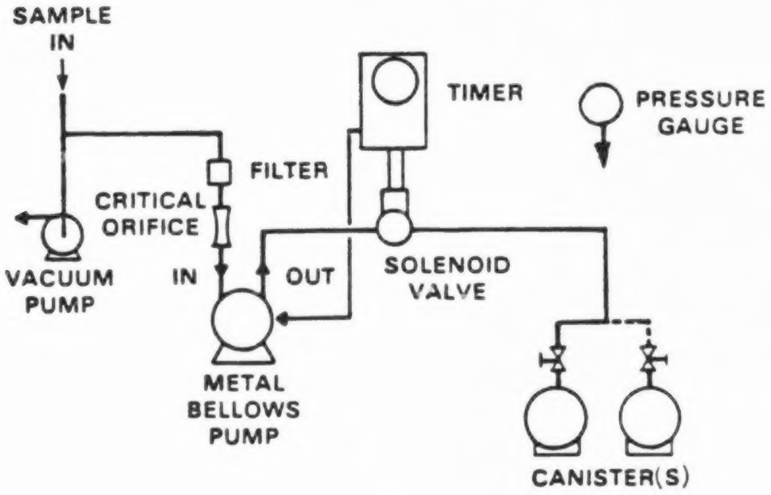
SAMPLE IN
TIMER
PRESSURE GAUGE
FILTER
CRITICAL ORIFICE
VACUUM PUMP
IN
OUT
SOLENOID VALVE
METAL BELLOWS PUMP
CANISTER(S)

Figure 2. Sample system for automatic collection of 3-hour integrated field air samples.

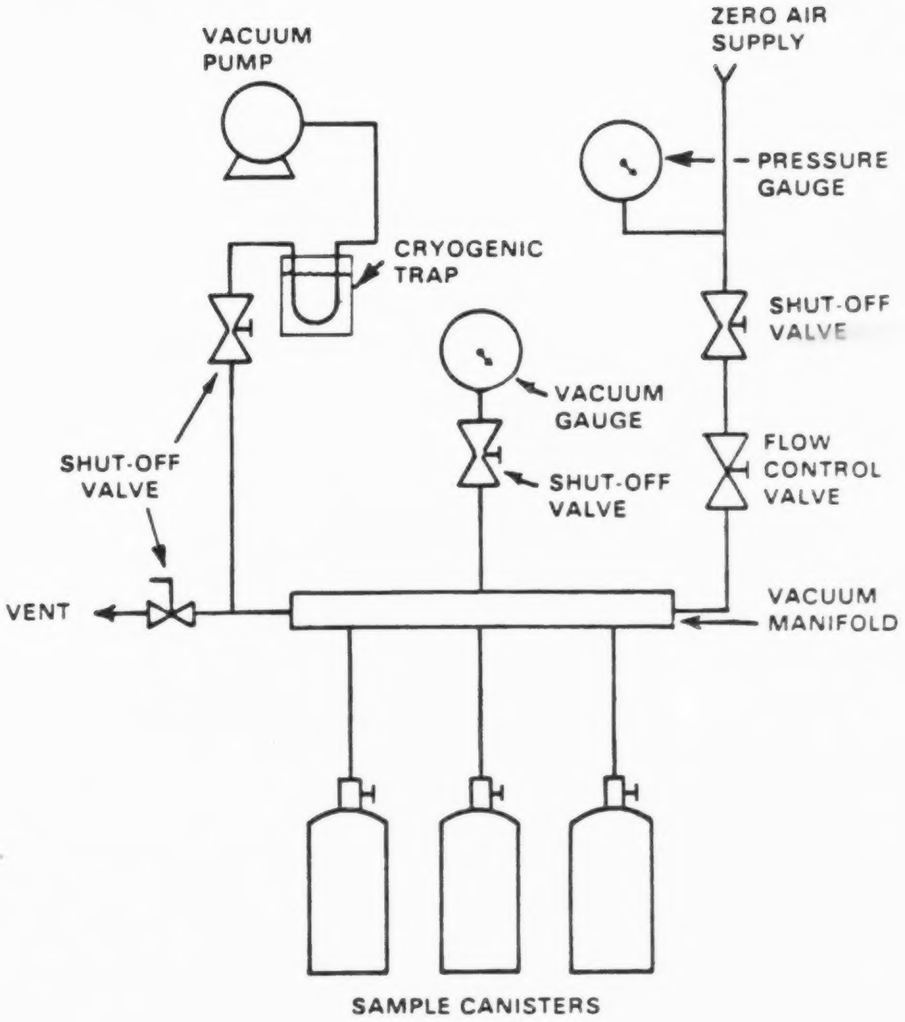
VACUUM PUMP
ZERO AIR SUPPLY
PRESSURE GAUGE
CRYOGENIC TRAP
SHUT-OFF VALVE
VACUUM GAUGE
SHUT-OFF VALVE
FLOW CONTROL VALVE
SHUT-OFF VALVE
SHUT-OFF VALVE
VENT
VACUUM MANIFOLD
SAMPLE CANISTERS

Figure 3. Canister cleaning system.

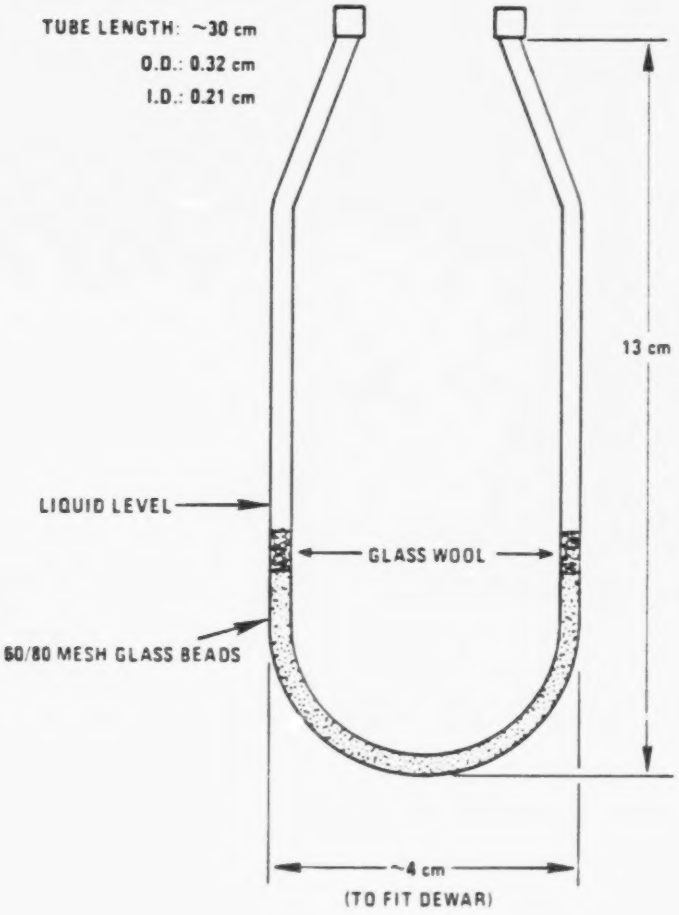
TUBE LENGTH: ~30 cm
O.D.: 0.32 cm
I.D.: 0.21 cm
13 cm
LIQUID LEVEL
GLASS WOOL
60/80 MESH GLASS BEADS
~4 cm
(TO FIT DEWAR)

Figure 4. Cryogenic sample trap dimensions.

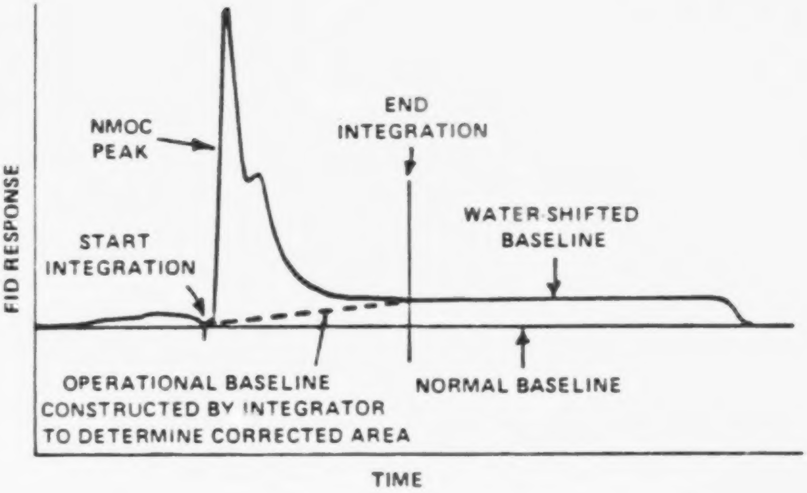

Figure 5. Construction of operational baseline and corresponding correction of peak area.

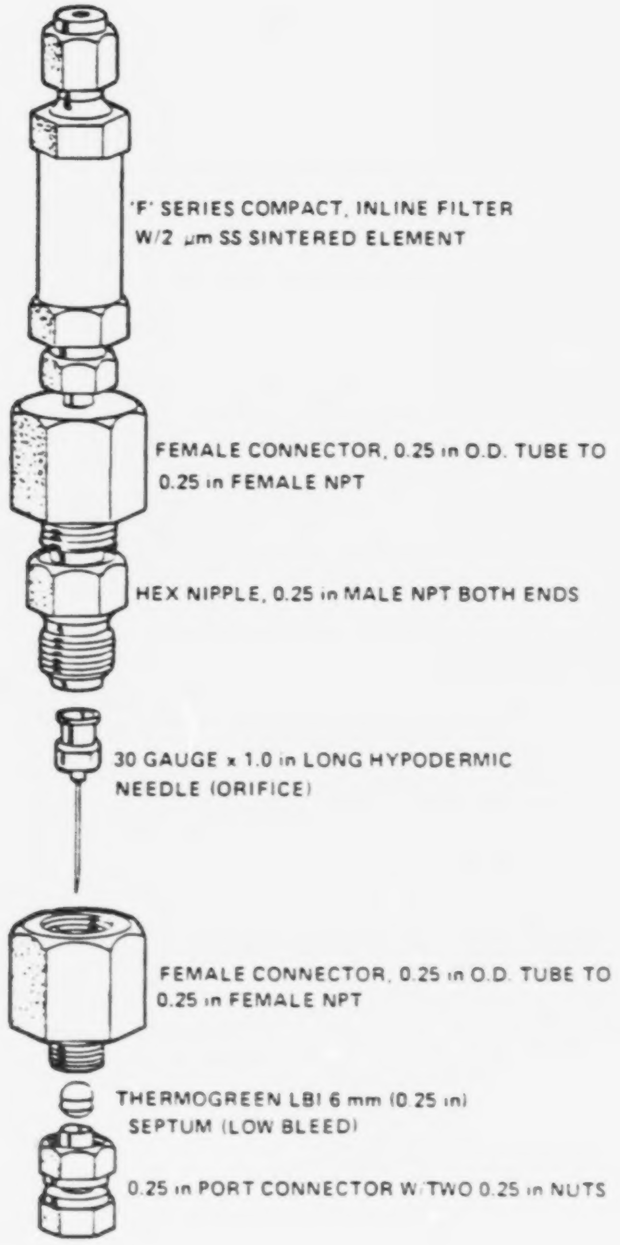
'F' SERIES COMPACT, INLINE FILTER
W/2 µm SS SINTERED ELEMENT
FEMALE CONNECTOR, 0.25 in O.D. TUBE TO
0.25 in FEMALE NPT
HEX NIPPLE, 0.25 in MALE NPT BOTH ENDS
30 GAUGE x 1.0 in LONG HYPODERMIC
NEEDLE (ORIFICE)
FEMALE CONNECTOR, 0.25 in O.D. TUBE TO
0.25 in FEMALE NPT
THERMOGREEN LBI 6 mm (0.25 in)
SEPTUM (LOW BLEED)
0.25 in PORT CONNECTOR W/TWO 0.25 in NUTS

Figure 6. Suggested filter and hyopdermic needle assembly for sample inlet flow control.

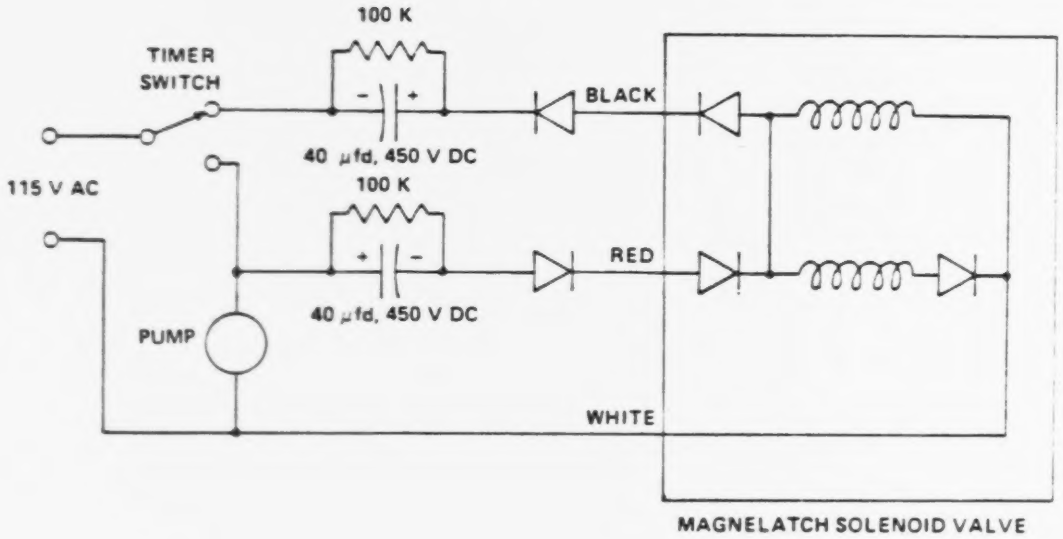
100 K
TIMER
SWITCH
BLACK
40 μfd, 450 V DC
115 V AC
100 K
RED
40 μfd, 450 V DC
PUMP
WHITE
MAGNELATCH SOLENOID VALVE

Figure 7. Electrical pulse circuit for driving Skinner Magnelatch solenoid valve with a conventional mechanical timer.

APPENDIX

ADDITIONAL INFORMATION CONCERNING SPECIAL PDFID METHOD COMPONENTS

	COMPONENT	IDENTIFICATION	SUPPLIER
1.	Sample canister	4-6 Liter	Scientific Instrumentation Specialists, Inc. P. O. Box 8941 Moscow, ID 83843 (208) 882-3860
2.	Absolute pressure gauge	Model 61C-ID-0410 (0-410 mm Hg), 6" Face	Wallace & Tiernam Div. of Pennwalt Corp. 25 Main Street Belleville, NJ 07109
3.	Six-port valve	Seiscor Model VIII	Seismograph Service Corp. Seiscor Division P. O. Box 1590 Tulsa, OK 74102
4.	Gas purifiers	Cat. #8125	Alltech Associates Deerfield, IL
5.	Chromatographic grade stainless steel tubing	Cat. #30101 (1/8" x 0.085")	Alltech Associates Deerfield, IL
6.	Laboratory gas chromatograph, with FID, flow controls, and integrator/recorder	HP Model 5840A or equivalent	Hewlett-Packard Corp. Avondale, PA 19311
7.	Metal bellows pump	Model MB-151	Metal Bellows Corp. 1075 Providence Highway Sharon, MA 02067
8.	Cryogenic Dewar	8600 (285 mL)	Pope Scientific Inc. Menomonee Falls, WI 53051
9.	Magnelatch solenoid valve	V5RAM49710	Skinner Valve New Britain, CT

APPENDIX B

INTEGRATOR PROGRAMMING INSTRUCTIONS

INTEGRATOR PROGRAMMING INSTRUCTIONS

Instructions for programming the integrators are as follows. Be sure to press ENTER after each key sequence.

Control Integrator

Oven Temp 90
Oven Temp Limit 405
Oven Temp ON
Oven Temp OFF
List Oven Temp
(A listing should say OvenTemp XC Setpt 90 C Limit 405 C)
Oven Temp Initial Time 0.20
Oven Temp Initial Value 90
Oven Temp Pgrm Rate 30.00
Oven Temp Final Value 90.00
Oven Temp Final Time 4.00
Oven Temp Equil Time 1.00

Detector A ON
Signal A Chart speed 4.00
%Offset 10 Zero
Attn 2^ 4

Run Time Annotation ON
Run Table Annotation ON
Clock Table Annotation OFF
Program Annotation OFF
Oven Temp Annotation OFF
Report Annotation OFF

Slave Integrator

Detector B ON
Signal B
Chart Speed 4.00
%Offset 10
Zero
Attn 2^ 4

```
Run Time Annotation ON
Run Table Annotation ON
Clock Table Annotation OFF
Program Annotation OFF
Oven Temp Annotation OFF
   (should say  ***Warning***Oven Temp now owned by Chnl 2)
Report Annotation OFF

     Control Integrator
     ------------------
Oven Temp Annotation OFF
   (should say ***Warning***Oven Temp now owned by Chnl 1)

Run Time 0.01 Intg OFF
Run Time 0.01 Valve 5 ON
Run Time 0.01 Page
Run Time 0.02 List Attn2^
Run Time 0.04 Oven Temp ON
Run Time 0.20 Valve 2 ON
Run Time 0.21 Valve 2 OFF
Run Time 0.22 Intg ON Run Time 0.23 Set BL
Run Time 0.23 List Intg
Run Time 1.87 Set BL
Run Time 1.88 Intg OFF
Run Time 1.89 List Intg
Run Time 1.90 Chart Speed 1.5
Run Time 3.50 STOP

     Slave Integrator
     ----------------
Run Time 0.01 Intg OFF
Run Time 0.01 Page
Run Time 0.02 List Attn2^
Run Time 0.22 Intg ON
Run Time 0.23 Set BL
Run Time 0.23 List Intg
Run Time 1.87 Set BL
Run Time 1.88 Intg OFF
Run Time 1.89 List Intg
Run Time 1.90 Chart Speed 1.5
Run Time 3.50 STOP

     Control Integrator
     ------------------
Det 1 Temp 250
Det 1 Temp Limit 405
Inj 1 Temp 31
Inj 1 Temp Limit 405
Aux 1 Temp 90
Aux 1 Temp Limit 405
Flow A 30 Flow A Limit 500.0
```

```
     Slave Integrator
     ----------------
Flow B 30
Flow B Limit 500.0

     Control Integrator
     ------------------
Valve 1 OFF
Valve 2 OFF
Valve 3 OFF
Valve 4 OFF
Valve 5 ON
Valve 6 OFF
Valve 7 OFF
Valve 8 OFF
Valve 9 OFF
Valve 10 OFF
Valve 11 OFF
Valve 12 OFF
Threshold 1
Peak Width 0.04

     Slave Integrator
     ----------------
Threshold 1
Peak Width 0.04

     Control Integrator
     ------------------
20 Valve 5 OFF
25 List Valve 5
30 Oven Temp
Initial Value 30
35 Oven Temp OFF
40 Wait 2
60 Start
70 Oven Temp 90
80 Valve 5 ON

Sync ON
```

APPENDIX C

STANDARD OPERATING PROCEDURE FOR PDFID SAMPLE ANALYSIS

STANDARD OPERATING PROCEDURE FOR PDFID SAMPLE ANALYSES

Nonmethane Organic Compounds

1.0 PURPOSE

The purpose of this SOP is to outline the procedures involved in the calibration and analyses of ambient air samples on a PDFID GC system.

2.0 APPARATUS/MATERIALS

2.1 HP 5880 Gas Chromatograph
2.2 HP 5880-A Level 4 Integrators
2.3 Course Flow Control Valves
2.4 Fine Flow Control Valves
2.5 Toggle Valve - Pressure
2.6 Toggle Valve - Vacuum
2.7 Absolute Pressure Gauge
2.8 Rotameter
2.9 Vacuum Pumps
2.10 Sample Introduction Ports
2.11 Sample Loops
2.12 Audio Indicator
2.13 Dewar Flasks
2.14 Calibration Manifold
2.15 Zero Air Shut Off Valve
2.16 Calibration Standard
2.17 Zero Air Standard
2.18 Sample Canister
2.19 Grade 5.0 Helium Carrier Gas
2.20 0.1 Grade Compressed Air
2.21 Grade 5.0 Hydrocarbon-free Hydrogen
2.22 Cryogen (Liquid Argon)

3.0 PROCEDURE

3.1 Precalibration

3.1.1 Make sure that the Helium cylinder has not been turned off
3.1.2 Turn the Hydrogen cylinder on and make sure the gauges read approximately 32 psig
3.1.3 After two minutes, turn on Compressed Air cylinder and make sure gauges read approximately 30 psig

3.1.4 Ignite Flame Ionization Detector units (A,B,C,D) (listen for audible pop)
3.1.5 Label current date on all 4 integrator charts
3.1.6 On integrators A and C (master integrators), press LIST ENTER
3.1.7 On integrators A and C press LIST PROGRAM ENTER
3.1.8 On all 4 integrators press
  LIST RUNTBL ENTER
  gold runtime
3.1.9 Turn on Vacuum Pumps

3.2 Calibration
3.2.1 Attach calibration manifold to Sample Introduction Ports on each GC
3.2.2 Turn on Zero Air Shut Off Valve
3.2.3 Connect Zero Air to Manifold and set Vent Flow at 150 (silver ball on rotameter) using the Course Flow Control Valves
3.2.4 Label integrator paper with "Initial Calibration", Current Date, Instrument Channel Indicator (Letter), and "Zero Air"
3.2.5 To Perform Zero Air Calibration
  a. Evacuate to 70mm by opening the Vacuum Toggle Valves.
  b. With Vent FLow at 150 open Pressure Toggle Valves and adjust the Fine Flow Control Valves to maintain Vent Flow below 20 but above 0 on rotameters.
  (DO NOT LET IT BOTTOM OUT!!!!!)
  Once at exactly 100mm, close Pressure Toggle Valves.
  c. Open GC door and place cryogen-filled Dewar flask on sample loops (DO NOT CLOSE DOOR!!!). Wait for cryogen to stop boiling.
  d. On Master integrator press START PROGRAM ENTER
  e. Open Pressure Toggle Valves and load to exactly 180mm by adjusting Fine Flow Control Valves to maintain Vent Flow below 20 but above 0. Once at exactly 180mm, close Toggle Valves.

  SAMPLE ALIQUOT IS DETERMINED BY POSITIVE DISPLACEMENT. EXACT DISPLACEMENT FROM 100mm TO 180mm IS CRUCIAL TO INSURE REPEATABILITY!

  f. When integrator prints "Ready for Injection" lift cryogen Dewar to top of sample loops and press STARTRUN on master integrator.
  g. When the audio indicator sounds, QUICKLY remove cryogen from sample loops and close GC door.

3.2.6 Repeat 3.2.5 until good repeatability is reached (i.e. as close to 0.00 (no peaks) as possible or a standard deviation of less than 0.02 Area Counts.)
Once attained, turn off Zero Air Shut Off Valve and disconnect Zero Air from Calibration Manifold and connect Calibration Standard to manifold.

3.2.7 To Perform Standard Calibration (Propane)

a. Evacuate to 70mm by opening the Vacuum Toggle Valves.
b. With Vent Flow at 150 open Pressure Toggle Valves and adjust the Fine Flow Control Valves to maintain Vent Flow below 20 but above 0 on rotameters.
(DO NOT LET IT BOTTOM OUT!!!!!)
Once at exactly 100mm, close pressure Toggle Valves.
c. Open GC door and place cryogen filled Dewar flask on sample loops (DO NOT CLOSE DOOR!!!). Wait for cryogen to stop boiling.
d. On Master integrator press START PROGRAM ENTER
e. Open Pressure Toggle Valves and load to exactly 180mm by adjusting Fine Flow Control Valves to maintain Vent Flow below 20 but above 0. Once at exactly 180mm, close Toggle Valves.

SAMPLE ALIQUOT IS DETERMINED BY POSITIVE DISPLACEMENT. EXACT DISPLACEMENT FROM 100mm TO 180mm IS CRUCIAL TO INSURE REPEATABILITY!

f. When integrator prints "Ready for Injection" lift cryogen Dewar to top of sample loops and press STARTRUN on master integrator.
g. When the audio indicator sounds, QUICKLY remove cryogen from sample loops and close GC door.

3.2.8 a. Repeat 3.2.7 until good repeatability is reached (i.e. There are two analyses with total area counts within 100 of each other) and use these to calculate mean span value.
Once reached, turn off Standard cylinder and disconnect from manifold.
b. Remove calibration manifold from sample introduction ports.

3.2.9 Calculate Mean Zero Air Area Counts and Mean Span Area Counts and calculate the Calibration Factor for each channel calibrated using the following equation:

$$\text{Calibration Factor} = \frac{[\text{ppmC Propane}]}{(\text{Mean Propane AC} - \text{Mean Zero Air AC})}$$

3.3 Analyses

3.3.1 Connect Sample Canister to Sample Introduction Port

3.3.2 Label integrator with Site Code and Radian ID#

3.3.3 Evacuate to approximately 70mm by opening the Vacuum Toggle Valves.

3.3.4 To analyze a sample

a. Open Sample Canister Valve completely.

b. Set Vent FLow at 150, open Pressure Toggle Valves and adjust the Fine Flow Control Valves to maintain Vent Flow below 20 but above 0 on rotameters.
(DO NOT LET IT BOTTOM OUT!!!!!)
Once at exactly 100mm, close pressure Toggle Valves.

c. Open GC door and place cryogen filled Dewar flask on sample loops (DO NOT CLOSE DOOR!!!). Wait for Cryogen to stop boiling.

d. On Master integrator press START PROGRAM ENTER

e. Open Pressure Toggle Valves and load to exactly 180mm by adjusting Fine Flow Control Valves to maintain Vent Flow below 20 but above 0. Once at exactly 180mm, close Toggle Valves and CLOSE CANISTER VALVES.

SAMPLE ALIQUOT IS DETERMINED BY POSITIVE DISPLACEMENT. EXACT DISPLACEMENT FROM 100mm TO 180mm IS CRUCIAL TO INSURE REPEATABILITY!

f. When integrator prints "Ready for Injection" lift cryogen Dewar to top of sample loops and press STARTRUN on master integrator.

g. When the audio indicator sounds, QUICKLY remove cryogen from sample loops and close GC door.

3.3.5 Repeat 3.3.4 up to 3 times, until standard deviation is less than 0.02 ppmC.

3.3.6 Calculate ppmC of sample by using the equation:

$$\text{ppmC} = (\text{Mean Total AC}) \times (\text{Calibration Factor})$$

Fill out the Sample Analysis Form completely.

3.4 Postcalibration

3.4.1 To Perform Zero Air Calibration

a. Evacuate to 70mm by opening the Vacuum Toggle Valves.

b. With Vent FLow at 150 open Pressure Toggle Valves and adjust the Fine Flow Control Valves to maintain Vent Flow below 20 but above 0 on rotameters.
(DO NOT LET IT BOTTOM OUT!!!!!)
Once at exactly 100mm, close Pressure Toggle Valves.

c. Open GC door and place cryogen-filled Dewar flask on sample loops (DO NOT CLOSE DOOR!!!). Wait for cryogen to stop boiling.

d. On Master integrator press START PROGRAM ENTER

e. Open Pressure Toggle Valves and load to exactly 180mm by adjusting Fine Flow Control Valves to maintain Vent Flow below 20 but above 0. Once at exactly 180mm, close Toggle Valves.

SAMPLE ALIQUOT IS DETERMINED BY POSITIVE DISPLACEMENT. EXACT DISPLACEMENT FROM 100mm TO 180mm IS CRUCIAL TO INSURE REPEATABILITY!

f. When integrator prints "Ready for Injection" lift cryogen Dewar to top of sample loops and press STARTRUN on master integrator.

g. When the audio indicator sounds, QUICKLY remove cryogen from sample loops and close GC door.

3.4.2 Repeat 3.4.1 until good repeatability is reached (i.e. as close to 0.00 (no peaks) as possible or a standard deviation of less than 0.02 Area Counts).
Once attained, turn off Zero Air Shut Off Valve and disconnect Zero Air from Calibration Manifold and connect Calibration Standard to manifold.

3.4.3 To Perform Standard Calibration (Propane)

a. Evacuate to 70mm by opening the Vacuum Toggle Valves.

b. With Vent Flow at 150 open Pressure Toggle Valves and adjust the Fine Flow Control Valves to maintain Vent Flow below 20 but above 0 on rotameters.
(DO NOT LET IT BOTTOM OUT!!!!!)
Once at exactly 100mm, close pressure Toggle Valves.

c. Open GC door and place cryogen filled Dewar flask on sample loops (DO NOT CLOSE DOOR!!!). Wait for cryogen to stop boiling.

d. On Master integrator press START PROGRAM ENTER

e. Open Pressure Toggle Valves and load to exactly 180mm by adjusting Fine Flow Control Valves to maintain Vent Flow below 20 but above 0. Once at exactly 180mm, close Toggle Valves.

SAMPLE ALIQUOT IS DETERMINED BY POSITIVE DISPLACEMENT. EXACT DISPLACEMENT FROM 100mm TO 180mm IS CRUCIAL TO INSURE REPEATABILITY!

f. When integrator prints "Ready for Injection" lift cryogen Dewar to top of sample loops and press STARTRUN on master integrator.

g. When the audio indicator sounds, QUICKLY remove cryogen from sample loops and close GC door.

3.4.4 a. Repeat 3.4.3 until good repeatability is reached (i.e. There are two analyses with total area counts within 100 of each other) and use these to calculate mean span value.
Once reached, turn off Standard cylinder and disconnect from manifold.

b. Remove calibration manifold from sample introduction ports.

3.4.5 Calculate Mean Zero Air Area Counts and Mean Span Area Counts and calculate the Calibration Factor for each channel calibrated using the following equation:

$$\text{Postcalibration Factor} = \frac{[\text{ppmC Propane}]}{(\text{Mean Propane AC} - \text{Mean Zero Air AC})}$$

3.5 Shut-down

3.5.1 Evacuate to 70mm by opening the Vacuum Toggle Valves
3.5.2 Turn off Vacuum Pumps
3.5.3 Turn off Hydrogen cylinder
3.5.4 After Hydrogen gauge reads approximately 0 psig, turn off Compressed Air cylinder.
3.5.5 IMPORTANT: DO NOT TURN OFF HELIUM CYLINDER!!!

APPENDIX D

SAMPLING SITES FOR THE 1987 NMOC PROGRAM

TABLE D-1. SAMPLING SITES FOR THE 1986 NMOC PROGRAM

SITE NO.	LOCATION	SITE CODE
1	Boston, MA (Chelsea)	B1MA
2	Boston, MA (E. Boston)	B2MA
3	Hartford, CT	HTCT
4	New York, NY (Bronx)	BNY
5	New York, NY (Manhattan)	MNY
6	Newark, NJ	NWNJ
7	Atlanta, GA	ATGA
8	Atlanta, GA (Decatur)	DEGA
9	Birmingham, AL	BHAL
10	Louisville, KY	L1KY
11	Chicago, IL (State Office Building)	C1IL
12	Chicago, IL (Sears Tower)	C3IL
13	Cincinnati, OH	CIOH
14	Baton Rouge, LA	BRLA
13	Beaumont, TX	BMTX
16	Dallas, TX	DLTX
17	El Paso, TX	ELTX
18	Ft.Worth, TX	FWTX
19	Houston, TX	H1TX
20	Longview, TX	LVTX
21	St. Louis, MO	SLMO
22	Salt Lake City, UT (North)	S1UT

TABLE D-1. SAMPLING SITES FOR THE 1986 NMOC PROGRAM (Continued)

SITE NO.	LOCATION	SITE CODE
23	Salt Lake City, UT (Central)	S2UT
24	El Cajon, CA	ELCA
25	Fresno, CA	FRCA
26	Livermore, CA	LICA
27	San Diego, CA	SDCA
28	San Francisco, CA	SFCA
29	Visalia, CA	VICA
30	Portland, OR	P1OR
31	Bakersfield, CA	BACA
32	Pittsburg, CA	PICA